The role of self-regulatory and social factors in health behaviour change

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Abstract

Smoking and overweight cause adverse health effects and increase morbidity and mortality. Nonetheless both are common. In Switzerland 37% of the adult population is overweight and 27% are smokers. To avoid the well-known health risks of smoking and overweight, it is necessary to change one’s behaviour.

In research about health behaviour change, different approaches have been applied to explain behaviour change, for example self-regulatory or social factors have been examined as determinants of behaviour. One of the several models which try to explain changes of health behaviours by focusing on individuals’ self-regulation is the health action process approach by Schwarzer. Another approach is chosen in the research about the effects of social relationships on health and health behaviour change. In these two research areas, both self-regulatory and social factors have been demonstrated as crucial in health behaviour change. However, these factors have mostly only been explored separately so far, with combinations being rare. Therefore the main purpose of this thesis was to examine self-regulatory and social factors in health behaviour change with the main focus being on combinations of these factors.

To shed further light on this research gap, this thesis contains two studies and the results of three papers. Both studies were larger research projects and followed overweight or smoking adults from the general Swiss population in a longitudinal design over the process of nutrition behaviour change and smoking cessation respectively.

Paper 1 investigated the role of a self-regulatory strategy, namely self-efficacy, in nutrition behaviour change. Results supported the phase-specific distinction of self-efficacy and indicated that phase-specific self-efficacies operate uniquely in the corresponding phase of behaviour change. Paper 2 focused on the combination of the research approaches on self-regulatory factors and social factors in smoking cessation. No main effects of the examined social
factor, i.e. social support, emerged, nor did it emerge for either of the self-regulatory strategies, which were examined according to the health action process approach. Moderator analyses indicated interacting effects between social support and self-regulation. A synergistic effect emerged: the combination of high levels of self-regulatory resources and high levels of social support was most beneficial in smoking cessation. Paper 3 focused on another research area which has so far been understudied: combinations of different social factors, namely social support and social control. This is surprising, because most married individuals report receiving social support and control from their spouse. Thus it was tested if combined effects of these social factors emerge in smoking cessation. The results showed no main effects of social support or social control but joint effects emerged. For individuals reporting average or low levels of social support, low levels of social control were beneficial regarding smoking behaviour.

Overall the findings demonstrate that combinations of self-regulatory and social factors may be more important than mere main effects. Social support seems to be a very important factor in health behaviour change because in its moderating role it affects relations between other factors and health behaviour. Further research is needed to understand the exact interplay of different factors in health behaviour change and to provide individuals with suitable interventions.
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I am indebted to everyone who made a contribution to the papers integrated in this thesis: the participants for their time and effort, the students who helped with data collection, and the co-authors for the fruitful collaboration. Further thanks go to my colleagues, especially to Dr. Pamela Rackow for the many discussions and her advice.

I wish to express my heartfelt gratitude to my family. Thank you for encouraging me and believing in me. I also thank Patrick for providing emotional and instrumental support 😊.

Finally I would like to dedicate this thesis to my wonderful mum,

who taught me what is really important in life.
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1 Introduction

Nowadays many people lead unhealthy lifestyles. Smoking, unhealthy eating, physical inactivity or excessive alcohol consumption are widespread, even though these behaviours cause adverse health effects and increase morbidity and mortality. Smoking and unhealthy eating have been identified as the leading non-genetic causes of death (Mokdad, Marks, Stroup, & Gerberding, 2004, 2005). To avoid these health risks, it is necessary to change one’s behaviour. Changing a particular behaviour, however, is a very difficult endeavour. For example, when trying to quit smoking, most people fail within the first weeks and after one year less than five percent manage to stay smoke-free (Hughes, Keely, & Naud, 2003).

In the field of health psychology, several models have been developed which try to explain and predict health behaviour or health behaviour change. Most models explore the role of self-regulation abilities and focus on cognitive factors (e.g., the health action process approach by Schwarzer, 1992, 2008). Parallel to the research on individual resources, there has been a long tradition in research about the effects of social relationships on health and on their role in health behaviour change (e.g., House, Landis, & Umberson, 1988). Although self-regulatory and social factors have been demonstrated to be crucial in health behaviour change, as yet these factors have mostly been examined separately so far, with combinations being very rare. Thus, the main purpose of this thesis is to explore the role of self-regulatory and social factors, and especially their combinations in health behaviour change. As health behaviours smoking and nutrition behaviour were chosen.

The focal points of this dissertation are the three integrated papers. In paper 1, the focus was on self-regulatory strategies in nutrition behaviour change, especially on self-efficacy. The main purpose was to examine the role of phase-specific self-efficacies across time in nutrition behaviour change. In paper 2, the approaches of research on individual resources and on social
resources were combined. The effects of self-regulatory factors and of social support on smoking cessation were examined. The main purpose was to analyse if combined effects of these factors emerge. It was tested whether social support can compensate for low levels of self-regulation or whether synergistic effects emerge. Paper 3 focused on different social factors, namely social support and social control. The main purpose was to analyse if joint effects of these social factors emerge in smoking cessation and if so, how they unfold. It was tested if the combination of high levels of social control and social support would be most beneficial for smoking cessation, which would thus indicate a synergistic effect.

The structure of this thesis is the following: Firstly, main constructs are described within the theoretical background. Nutrition behaviour and smoking are included as the focal health behaviours. Models of self-regulatory factors in health behaviour change, in particular the health action process approach, are then described. Thereafter, the social perspective of health behaviour is presented. Social support and social control as social processes are introduced and the interplay of these factors is described. Finally, the interplay of self-regulatory and social factors in health behaviour change follows.

After the theoretical background, the research questions are presented and the two studies, in which the data that was analysed in this thesis originated, are described. The following three chapters then contain the three papers integrated in this thesis.

The last chapter consists of an overall discussion. First, the main results of the three papers are discussed. The methodological aspects regarding the research design, samples and measures, are then considered. Afterwards, limitations and strengths are discussed and implications for future research and recommendations for practice are presented. Finally, general conclusions will be drawn.
2 Theoretical Background

In this chapter the examined health behaviours, smoking and nutrition behaviour, are described, followed by the applied theoretical model for individual self-regulation, namely the health action process approach. Finally, descriptions about social processes in health behaviour change and their interplay with self-regulatory factors will follow.

2.1 Change of health-enhancing and health-compromising behaviours

In this section the specific health behaviours which are examined in this thesis are described. Healthy nutrition behaviour was chosen as an example of a health-enhancing behaviour. Since unhealthy nutrition behaviour most likely leads to being overweight, this is also described. In contrast, smoking was chosen as a health-compromising behaviour.

2.1.1 Nutrition behaviour and overweight

Unhealthy nutrition can be responsible for several diseases, such as coronary heart disease, cancer or diabetes, whereas a healthy nutrition can be seen as a protective factor regarding diseases. The Swiss Society for Nutrition (SSN, 2011) recommends that adults base their nutrition on the nutrition pyramid, which should provide all the essential nutrients. The nutrition pyramid includes the following: drinking at least one or two litres per day (preferably in the form of water, tea or other sugar-free drinks), eating five portions of fruit and vegetable per day (preferably three portions should be vegetables), three portions of potatoes, grains or pulses (preferably whole grain), three portions of milk or dairy products, one portion of meat, poultry, fish, egg or tofu, two or three tablespoons of vegetable oil and one portion of unsalted nuts, seeds or kernels. Sweets, sweetened drinks, salty snacks and alcoholic beverages should be consumed in moderation (SSN, 2011). However, over recent decades food habits have changed, which have
resulted in the consumption of more fatty and sugary food, leading to a higher risk of overweight (World Health Organization, WHO, 2000).

Overweight is defined as excessive body fat and can be considered a major problem of an unhealthy nutrition. It is usually assessed by the body mass index (BMI), which is a calculation based on body weight in kilogrammes, divided by the squared height in metres. Adults with a BMI above 25 are classified as overweight and those with a BMI above 30 are classified as obese, as displayed in Table 1 (WHO, 2000).

Table 1.

Classification of overweight and obesity according to the BMI (WHO, 2000)

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI</th>
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<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5 – 24.9</td>
</tr>
<tr>
<td>Overweight:</td>
<td>≥ 25</td>
</tr>
<tr>
<td>Overweight</td>
<td>25 – 29.9</td>
</tr>
<tr>
<td>Obesity grade I</td>
<td>30 – 34.9</td>
</tr>
<tr>
<td>Obesity grade II</td>
<td>35 – 39.9</td>
</tr>
<tr>
<td>Obesity grade III</td>
<td>≥ 40</td>
</tr>
</tbody>
</table>

The prevalence of overweight and obesity has been described as reaching epidemic proportions around the world, in Western as well as in developing countries. In most countries the prevalence has heavily increased over the last decades (Caballero, 2007). In Switzerland 29% of the adult population is overweight and an additional 8% are obese, resulting in 37% overall (46% of men and 29% of women) with a body weight too high (Eichholzer, Bovey, Probst-Hensch, & Stoffel-Kurt, 2010). About 30% report not to care at all about their nutrition behaviour. Only 30% eat the recommended five portions of fruit and vegetables and only 10% eat the recommended three portions of milk or dairy products per day. Especially men, young
individuals and individuals with a lower socio-economic background do not base their nutrition on the recommended guidelines (Eichholzer et al., 2010). A similar trend can be found in the population of children in Switzerland: about every fifth child is overweight and every twentieth child is obese (Zimmermann, Gübeli, Püntener, & Molinari, 2004).

The causes for being overweight are simple but the consequences are diverse. The leading cause is a permanent imbalance between energy intake and energy use. If more energy is consumed by food and drinks than used by body functions and exercise, the result is a positive energy balance. The remaining energy is saved as body fat and will likely lead to being overweight (Hill, Saris, & Levine, 2004). Besides the imbalance of energy intake and usage, behavioural, biological or environmental factors are also considered, which makes overweight a multifactorial problem. An example of a behavioural factor is the increase of the consumption of sweetened drinks and the increasing food portion sizes over the last 30 years (Nielsen & Popkin, 2003, 2004). As biological factors, several genes and their interactions which may be related to being overweight have been discussed. Although so far there is no known specific single “obesity gene” (Rankinen et al., 2006). As environmental factors Wadden, Brownell, and Foster (2002) speak of a “toxic environment” which discourages physical activity while explicitly encouraging the consumption of large portions of high-fat and sugary food, as for example with snack vending machines at schools.

Overweight and especially obesity cause severe diseases. They are related to the incidence of type II diabetes, different types of cancer, cardiovascular disease, asthma, gallbladder disease, osteoarthritis and chronic back pain. Overall they are associated with a higher risk of morbidity and mortality (Guh et al., 2009) and are one of the leading causes of death (Mokdad et al., 2004). Naturally, the increased risk for diseases also leads to a high financial cost for medical treatments (Schmid, Schneider, Golay, & Keller, 2004). Besides the severe medical and financial
consequences, overweight also has psychological and psychosocial consequences. Obese individuals cannot hide their overweight and the accompanying restricted physical movement. Stigmatisation, or even discrimination, is documented in diverse important areas of living such as employment, education or health care (Puhl & Brownell, 2001).

The basic principle of overweight and obesity treatment can be derived from the main cause: the imbalance between energy intake and energy use needs to be changed. By modification of the eating behaviour less energy should be consumed, and by modification of the exercise behaviour more energy should be spent. To keep a healthy weight the energy balance needs to be kept lifelong. For severe obesity, pharmaceutical and bariatric surgical interventions are also considered, but always have to be accompanied by a change of nutrition and exercise behaviour (National Institutes of Health, NIH, 1998). As reported above, a healthy nutrition can be achieved by following the principle of the nutrition pyramid which is well-balanced and low in fat (SSN, 2011). Following a low-fat nutrition leads to better satiety, palatability, and more weight loss compared to other diets (Astrup, Grundwald, Melanson, Saris, & Hill, 2000; Shah, McGovern, French, & Baxter, 1994) and is recommended in order to maintain a lifelong healthy weight (Shick et al., 1998). Besides unhealthy eating and overweight, smoking is another unhealthy behaviour which is common around the world.

### 2.1.2 Smoking

Smoking is defined as the consumption of any tobacco products, whereas a smoker is an individual who smokes (even if rarely) and who has smoked more than 100 cigarettes in the past (WHO, 1998). Individuals can be classified as never smokers (those who have never smoked or have smoked fewer than 100 cigarettes in their lives), former smokers (those who have stopped smoking, but have smoked more than 100 cigarettes before), occasional smokers (those who smoke but not daily) and daily smokers (those who smoke every day; WHO, 1998).
Smoking is a behaviour performed everywhere in the world with usually higher prevalence rates in low- and middle-income countries. In these countries prevalence rates are currently still increasing whereas prevalence rates have decreased in many high-income countries over the last years (WHO, 2011). In 2010 the prevalence rates in Switzerland among the 14- to 65-year olds were as follows: 19% daily smokers, 8% occasional smokers, 20% former smokers and 53% never smokers (Keller, Radtke, Krebs, & Hornung, 2011). Overall 27% of the adult population was classified as smokers and smoked on average 11.5 cigarettes per day (daily smokers smoked 14.2 cigarettes and occasional smokers smoked 1.2 cigarettes per day). More men (30%) than women (24%) and more individuals with lower education (32%) than with higher education (24%) smoked. By differentiating the adult population by age the following picture emerged: 24% of the 14-19-year olds smoked, 39% of the 20-24-year olds, 30% of the 25-34-years olds, 25% of the 35-44-year olds, 28% of the 45-54-years olds and 21% of the 55-65-year olds smoked. In general, the prevalence for smoking has decreased in Switzerland over the last years (Keller et al., 2011).

Smoking causes severe diseases. It harms nearly every organ of the body and reduces the health of smokers in general, beginning before birth and continuing across the life span (U.S. Department of Health and Human Services, 2004). The evidence is sufficient to infer a causal relationship between smoking and several types of cancers, such as lung cancer, laryngeal cancer, oral cavity and pharyngeal cancers, esophageal cancer, pancreatic cancer, bladder and kidney cancers, cervical cancer, gastric cancer or acute leukaemia. Besides cancer, smoking also causes several cardiovascular diseases (e.g., coronary heart disease, stroke, atherosclerosis, subdominal aortic aneurysms) and respiratory diseases (acute respiratory illnesses, major respiratory symptoms as coughing, phlegm, wheezing, dyspnoea). Smoking causes reduced fertility in women, and women who smoke during pregnancy risk reduced fetal growth and a low birth
weight of the baby. In older women smoking causes a low bone density. Apart from the increased risk for morbidity smoking also causes a higher mortality (e.g., Jacobs et al., 1999; U.S. Department of Health and Human Services, 2004). It is the leading cause of preventable death (Mokdad et al., 2004, 2005). Up to every second smoker will die from a tobacco-related disease. Smoking kills nearly 6 million people per year and causes billions of dollars of economic damage worldwide (WHO, 2011).

Smoking does not only affect smokers as being exposed to second-hand smoke causes diseases in non-smokers as well. Second-hand smoke, also known as environmental tobacco smoke or involuntary smoking, is a mixture of sidestream smoke (the smoke from the burning end of a tobacco product) and the mainstream smoke exhaled by a smoker. The evidence is sufficient to infer a causal relationship between the exposure to second-hand smoke and diseases such as lung cancer or coronary heart disease in non-smoking adults. Overall it increases morbidity and mortality (U.S. Department of Health and Human Services, 2006). Nevertheless many people are exposed to secondhand smoke, e.g. only 42% of the adult population in Switzerland report no secondhand smoke exposure at all, resulting in 58% who report at least some exposure. Second-hand smoke exposure takes place at the workplace, in restaurants, bars, at friends’ or at home (Radtke, Keller, Krebs, & Hornung, 2011). Living with a smoking spouse is especially harmful, as adult non-smokers have a 23% greater risk of ischaemic heart disease (Law, Morris, & Wald, 1997) and a 24% greater risk of lung cancer (Hackshaw, Law, & Wald, 1997) if they live with a smoker. Being exposed to second-hand smoke is further particularly dangerous to children. It increases the risk of sudden infant death syndrome, acute respiratory infections, middle-ear infections and severe asthma. Smoking parents risk respiratory symptoms and slowed lung growth in their children (U.S. Department of Health and Human Services, 2006).
If smoking is this harmful, the question raises why so many people all over the world actually smoke. First of all, it has to be taken into account that not all smokers know about the harmful effects of smoking. In Western countries most people are informed of the risks of smoking and of the exposure of second-hand smoke (e.g., in Switzerland, Radtke, Keller et al., 2011; in US, U.S. Department of Health and Human Services, 2004, 2006), whereas in many developing countries the majority of the population is not aware of the effects on health. Since the prevalence rates are usually higher in these countries, more people are unaware of the harmful effects of smoking than are informed as seen from a worldwide perspective (WHO, 2011).

Secondly, up to 70-80% of the smokers meet the criteria for nicotine dependence according to the DSM-IV/ICD-10 (Batra & Fagerström, 1997; Breslau, Johnson, Hiripi, & Kessler, 2001; Knoll, Scholz, Rieckmann, 2011). If only this physical addiction maintained smoking behaviour, nicotine replacement products would be successful with all smokers, but this is not the case. Instead, smoking is a rather multifactorial addiction with physical, mental and social factors being crucial in the initiation, maintenance and cessation of smoking (Gwaltney, Metrik, Kahler, & Shiffman, 2009; Homish & Leonard, 2005; Park, Tudiver, Schultz, & Campbell, 2004). This also makes smoking cessation very hard to accomplish. Although many smokers are motivated to quit (e.g. 48% of all smokers in Switzerland intend to quit, Keller et. al., 2011) only a few will succeed in maintaining abstinence (Hughes, Keely, & Naud, 2003). Many self-quitters (i.e. trying to quit without any help) manage to stay smoke-free for a few days, but then start to have lapses (i.e. a little slip-up while smoking a puff or a maximum of five cigarettes) and eight days after the quit date the majority has relapsed (i.e. a total fallback with returning to smoking regularly). One month after the quit date on average 15-28% maintain abstinence while six months after the quit date on average 5% and twelve months later even less (Hughes, Keely, & Naud, 2003).
This small number of successful quitters may seem disencouraging, but smokers who succeed are rewarded with major health benefits. Smoking cessation has immediate health benefits for women and men as well as young and older adults. The risk of diseases caused by smoking (e.g., cancer or coronary heart disease) immediately decreases and after about 15 years of smoking-abstinence the risk is about the same as for individuals who have never smoked. Quitting smoking also increases life expectancy. Smokers who quit before the age of 50, for example, have only half the risk of dying in the following 15 years compared to individuals who continue smoking (U.S. Department of Health and Human Services, 1990).

2.2 Models of self-regulatory factors in health behaviour change

As the previous chapters have demonstrated, many people adopt behaviour patterns which are harmful to their health. However, changing behaviours in general and in particular, changing health behaviour, is a very difficult endeavour. Several psychological constructs have attempted to explain why certain behaviours are conducted, and several theories have been developed to explain health behaviour as well as to predict health behaviour change. In many models, e.g., in the theory of planned behaviour (Ajzen, 1991) or the protection motivation theory (Rogers, 1975), intentions are regarded as the most important predictor in health behaviour change. However, in meta-analyses intentions are able to explain about 20-30% of the behaviour variance and up to 80% remain unexplained and therefore need to be explained by other factors. Many people are motivated to change their behaviour and have built an intention but fail to translate it into action. This phenomenon is called the intention-behaviour gap (Sheeran, 2002). It seems that intention by itself is not sufficient to predict behaviour. In a study by Orbell and Sheeran (1998), no differences were found in the intentions between individuals who implemented a behaviour and individuals who failed. Since both groups were able to build an intention, the difference in the implementation of the behaviour cannot be found in the phase of motivation, but has to be
located in the volitional phase where intentions are translated into actions (Orbell & Sheeran, 1998). One of the first models differentiating between motivation and volition was the rubicon model (Heckhausen, 1991), which assumes different phases of action. In this model everything which happens up to and including the building of an intention belongs to the motivational phase, whereas the processes which translate the intentions into action belongs to the volitional phase (Heckhausen, 1991). A further emulation of the rubicon model is the health action process approach (HAPA) by Schwarzer (1992, 2008).

2.2.1 The health action process approach

The HAPA-model also comprises a motivational and a volitional phase. It mainly focuses on the process of translating intentions into action and can be seen as an approach to bridge the intention-behaviour gap (Schwarzer 1992, 2008). The HAPA-model belongs to the stage theories of health behaviour. These theories assume that an individual has to undergo qualitative-different phases during the process of behaviour change (Weinstein, Rothman, & Sutton, 1998). Stage theories stand in contrast to continuum theories (e.g. the theory of planned behaviour, Ajzen, 1991; protection motivation theory, Rogers, 1975) which assume that individuals are placed along a continuum of action likelihood. Stage theories and continuum theories also differ in the intervention: in the latter the same intervention is applied to all individuals whereas in stage theories interventions are tailored to specific phases, meaning only individuals in the same stage receive the same intervention (Weinstein et al., 1998).

The motivational phase of the HAPA-model aims at building intentions for a particular behaviour (see Figure 1). Risk awareness, outcome expectancies and self-efficacy are assumed predictors of intention formation. Risk awareness or risk perception, as it is also called, contains the subjective beliefs about one’s vulnerability regarding diseases and about the severity of these diseases. To comprehend that one’s own behaviour is related to one’s health is a necessary basis
to start the process of behaviour change (Schwarzer, 1992, 2008). However, risk awareness is insufficient to enable intention formation, and fear appeal itself does not cause behaviour change either (Ruiter, Abraham, & Kok, 2001). Risk awareness is rather a distal antecedent and sets the stage for a contemplation process. In the further elaboration of the process of health behaviour change, \textit{outcome expectancies} about positive and negative consequences of the behaviour change are balanced. The more advantages (positive outcome expectancies) and the fewer disadvantages (negative outcome expectancies) are expected to result from the behaviour change, the more likely it will be implemented. Outcome expectancies cannot explain if an individual also feels capable of conducting a particular behaviour which is necessary in the process of behaviour change. This belief about one’s own capability refers to the \textit{motivational self-efficacy}, also called task self-efficacy. When the intention to change particular health behaviour is formed, the motivational phase is completed and the volitional phase starts. In the volitional phase the intention is transformed into action, including processes of initiating the behaviour, maintaining it and recovering from lapses. To master these difficult tasks and to bridge the intention-behaviour gap, self-regulation skills are crucial. Besides intentions, \textit{volitional self-efficacy}, \textit{action} and \textit{coping planning} and \textit{action control} are specified as predictors of behaviour in the HAPA-model (Schwarzer, 1992, 2008, see Figure 1).

Self-efficacy as well as outcome expectancies originate from the social-cognitive theory by Bandura (1977, 2001). Self-efficacy is defined as the self-confidence in one’s own capability to initiate a behaviour, maintain it even if obstacles emerge and readopt it after a lapse. Self-efficacy is crucial in the motivational and the volitional phase and can therefore be differentiated into phase-specific self-efficacies. This distinction was developed due to the assumption that people have to succeed in different tasks during the process of behaviour change and that different phase-specific self-efficacies support these tasks. The concept of phase-specific self-
efficacies was first used in the domain of addictive behaviours (Marlatt, Baer, & Quigley, 1995). These days it is used in various behaviours and is defined and labelled differently by different authors. In the motivational phase of the HAPA-model the *motivational self-efficacy*, or task self-efficacy, which refers to optimistic beliefs about the overall confidence to perform a behaviour and to initiate the behaviour change, is one of the predictors of intention formation. In the volitional phase the *volitional self-efficacy* is a predictor of the behaviour. Volitional self-efficacy can be further differentiated into the maintenance self-efficacy and the recovery self-efficacy. Maintenance self-efficacy refers to beliefs about one’s ability to maintain behaviour over a long period of time and even if obstacles emerge. Recovery self-efficacy refers to beliefs about one’s ability to readopt the behaviour after a lapse (Schwarzer, 2008). Besides the phase-specific approach, Bandura (1997) further differentiated self-efficacy into different domain-specific self-efficacies, e.g., one might have a high self-efficacy regarding healthy nutrition but a low self-efficacy regarding physical exercise (Bandura, 1997).

The effects of *action planning* were already explored in 1965 (Leventhal, Singer, & Jones). Action planning refers to the formulation of simple plans about when, where and how to perform a particular behaviour, and is comparable to the concept of implementation intentions by Gollwitzer (1999). Action plans link a particular behaviour to situational cues so that in this specific situation the behaviour is performed almost automatically. A further development of the concept of planning differentiated between action planning and coping planning (Sniehotta, Schwarzer, Scholz, & Schuez, 2005). *Coping planning* refers to a mental link between anticipated risk situations and appropriate coping responses. By anticipating personal risk situations, which hinder the behaviour performance as it was intended, and by providing coping responses for these situations, coping planning can enable individuals to overcome barriers and to cope with difficulties in behaviour change. Since in risk situations a particular coping strategy is available,
coping planning can protect our good intentions (Sniehotta, Schwarzer, et al., 2005). So far few studies have tested if the repeated formation of action and coping plans is beneficial to health behaviour change and if it is more effective than single planning (e.g. Luszczynska, 2006; Luszczynska, Sobczyk, & Abraham, 2007). It seems that the repeated planning is related to longer-term effects in health behaviour change, but it remains yet unclear which quantity of action and coping plans is most beneficial. In the first publications about the HAPA-model, coping planning was not always integrated.

Another component not always included in the HAPA-model is action control (Schwarzer, 1992, 2008). Action control is a strategy to monitor one’s own behaviour, to be aware thereof and to confer it with one’s intentions and to put up self-regulatory effort if a discrepancy between intentions and actions is noticed (Sniehotta, Scholz, & Schwarzer, 2005). The concept behind it is based on negative feedback loops, which is derived from cybernetic models of self-regulation (Carver & Scheier, 1998). Three cognitive processes are considered: self-monitoring (monitoring one’s behaviour), awareness of standards (keeping one’s standards and intentions in mind), and self-regulatory effort (making an effort if the standards are not achieved; Sniehotta, Scholz, et al., 2005). These three processes are summed up as action control in this thesis.

As the description of the predictors in the volitional phase indicates, the process of health behaviour change is not finished with the successful implementation of a new behaviour. After the initiation this behaviour needs to be maintained and re-established after lapses. Overall the HAPA-model has been applied in the domains of various health behaviours including the two analysed behaviours in this thesis, namely smoking and nutrition behaviour (e.g., Scholz, Nagy, Goehner, Luszczynska, & Kliegel, 2009; Schwarzer & Luszczynska, 2008; Schwarzer et. al.,
2 Theoretical Background

2007). It has been demonstrated to be of good applicability, universality and predictive validity regarding different health behaviours and different populations (Schwarzer, 2008).

As displayed in Figure 1, barriers and resources affect the process of behaviour change. One of these resources is social support, which plays a crucial role but is not further specified in the HAPA-model. The next chapter will illustrate the role of social support and other social processes in health behaviour change.

![The health action process approach (HAPA) by Schwarzer (1992, 2008)](image)

*Figure 1. The health action process approach (HAPA) by Schwarzer (1992, 2008)*

### 2.3 Social processes in health behaviour change

Social processes have been proven to be important for one’s health and to play a significant role in health behaviour (e.g., House et al., 1988). Hence, social processes are taken into account in different theories of behaviour change, e.g., in Bandura’s social-cognitive theory...
(1977, 2001). As stated in the previous chapter, social resources are mentioned in the HAPA-model as well but are not further specified.

There has been a long tradition in research about the role of social relationships in health behaviour change and on the effects of social relationships on health. These relations can be explored twofold: regarding the quantitative aspects of social relationships (the social integration of an individual) and regarding the qualitative aspects of social relationships (e.g., social support or social control) (e.g., Berkman, Glass, Brissette, & Seeman, 2000; House et al., 1988). In the beginnings of this research tradition, mostly quantitative aspects of social relations were examined. Social resources were often assessed as the number of social relationships an individual has or with the marital status. These measures of social integration, however, neglect to take into account the quality of these relationships. Moreover, they cannot show how a relationship has to be to be supportive and how social relationships affect an individuals’ health. To answer such questions qualitative aspects of social relationships needed to be taken into account. In this thesis, social support and social control are examined as qualitative aspects. In the next section social support will be described, followed by social control. Finally, the interplay of social processes will be explored.

2.3.1 Social support

In this chapter social support is defined. Thereafter, the association between social support and health and between social support and health behaviour change are described.

Social support, which is an interactive process between a provider and a receiver, refers to the function and quality of social relationships. The interaction aims at increasing stressful situations or helping the receiver to cope with a difficult situation in a functional manner. Social support can be differentiated into perceived and received support (e.g., Schwarzer & Knoll, 2010). Perceived social support comprises anticipated support from the network that is available
if needed and the general satisfaction with support provided. As a general expectation of potential support in a future emergency situation, it is related to personality dispositions such as optimism and is relatively stable across time and situations (Sarason, Sarason, & Shearin, 1986). In contrast, *received* social support refers to reports of actual transactions that were obtained in the past. These retrospective reports are recalled by the receiver who has interpreted the actions of the provider as supportive (Schwarzer & Knoll, 2010). Correlations between *received* and *perceived* social support are rather low, since according to the different definitions and measurements, these two facets of social support do not necessarily need to have much in common (Haber, Cohen, Lucas, & Baltes, 2007). Although assessing *perceived* support can be seen as exploring a stable personality disposition whereas assessing *received* support refers to the concrete and stalwart support transactions (Uchino, 2009), more studies still focus on *perceived* than *received* support (Böhmer, Luszczynska, & Schwarzer, 2007). Furthermore, there is very little research that examines interactions between *perceived* and *received* support (Uchino, 2009). *Perceived* and *received* social support both refer to the perspective of the support receiver. The receiver can report support from different support providers. Usually support from the family, partner and friends are reported. For adult individuals living with a partner or spouse, this person is the most important source of social support (Schwarzer & Gutierrez-Dona, 2005).

Besides the differentiation of *received* and *perceived* support, different functions of social support can also be distinguished, like emotional support, instrumental support and informational support (Schwarzer & Knoll, 2010). Emotional support refers to actions such as reassurance or giving comfort, and it aims at improving the emotional well-being of the receiver. Instrumental support includes giving tangible support, which can mean donating goods or helping with a certain task. Informational support refers to giving advice or gathering and providing necessary information (Schwarzer & Knoll, 2010).
Social support is very important for an individual’s health. Meta-analyses showed that social support is related to mental and physical health (Prati & Pietrantoni, 2010; Uchino, Cacioppo, & Kiecolt-Glaser, 1996), e.g., social support is related to aspects of the cardiovascular, endocrine and immune system. Health benefits of social support are well-documented but it is less clear how, when and why these effects work. Besides direct effects of social support on health, social support may also have indirect effects. To shed more light onto these open questions, mediator and moderator analyses can be helpful. A moderator is a variable that affects the direction or strength of the relation between a predictor variable and a criterion variable. Whereas a moderator specifies when an effect will occur, a mediator explains how or why a particular effect occurs. Thus, a mediator variable accounts for the relations between a predictor and a criterion variable (Baron & Kenny, 1986). Social support has been tested as moderator and mediator. Studies on recovery from traumatic stress have demonstrated that social support enhanced self-efficacy and that enhanced self-efficacy was related to better recovery from post-traumatic events. This model with self-efficacy mediating the effects of social support on health outcomes is called enabling effect (Benight & Bandura, 2004). Another approach is chosen in the stress-buffering effect (Cohen & Wills, 1985). It postulates that social support reveals beneficial effects on health only in stressful situations and that social support buffers the negative effects of these situations. Hence, social support is seen as a moderator on the relationship between stress and health (Cohen & Wills, 1985).

Another explanation regarding the relationship between social support and health may lie in health-related behaviours. When being in company individuals may change or perform other health-related behaviours than when being alone (e.g., when a smoker spends time with non-smoking friends, the probability that he/she abstains from smoking is likely higher than when spending time with friends who smoke). Previous chapters described the dangers of unhealthy
eating and smoking as examples of health-compromising behaviours. If social support is beneficial to staying smoke-free or eating healthily, these health risks can be avoided. Eating is a behaviour often conducted in company. In traditional families, one person might be responsible for the provision of food for the whole family. It might therefore be assumed that social support plays a role in healthy eating. Social support is associated with healthy eating (Jackson, 2006; Trasher, Campbell & Oates, 2004), with changes in dietary behaviour (Kelsey et al., 1996) and with changes in fruit and vegetable intake (Steptoe, Perkins-Porras, Rink, Hilton, & Cappuccion, 2004). Regarding smoking, studies have demonstrated beneficial effects of social support in smoking cessation (e.g., Carlson, Goodey, Hahn Bennett, Taenzer, & Koopmans, 2002; Gulliver, Hughes, Solomon, & Dey, 1995; Park et al., 2004). Furthermore, social support can be helpful in different aspects of smoking (adapted from Knoll et al., 2011). First of all, smoking cessation is a very stressful endeavour (McMahon & Jason, 1998). According to the stress-buffering effect (Cohen & Wills, 1985), social support may buffer some distress. Secondly, the social network might enhance the self-efficacy via vicarious experience (a member of the network with successful smoking cessation sets a model for the cessation behaviour) and symbolic experience (via verbal persuasion, members of the social network affirm the smoker that he/she is able to quit; sources of social support see e.g., Bandura, 1977). Enhanced self-efficacy increases intention formation to quit smoking as well as smoking cessation itself. Thirdly, members of the social network may communicate the health risks of smoking. Other than supporting the smoker in quitting, members of the social network may also try to influence the smoking behaviour via social control which is described in the next chapter.

2.3.2 Social control

Social control is defined as attempts to regulate or influence the behaviour of another person. These attempts are taken regardless of the intention of the person and even if she/he is not
willing to change a certain behaviour. Social control includes strategies such as giving advice, persuading, nagging, or withdrawing (Butterfield & Lewis, 2002; Lewis & Rook, 1999). Social control can be differentiated into direct and indirect control. The latter is applied if a person internalises a sense of obligation to a significant other and therefore avoids health-compromising behaviours to make sure these obligations are not endangered. Direct control is applied when significant others prompt a person to perform health-enhancing behaviours or to quit health-compromising behaviours (Lewis & Rook, 1999). A more common differentiation of social control is between positive and negative social control. Positive control refers to strategies such as praising or complimenting the targeted behaviour or making suggestions. Negative control comprises strategies such as nagging or trying to make the other person feel guilty when the undesirable behaviour is performed (Butterfield & Lewis, 2002). These strategies show that social control is an interactive process between a provider and a receiver, as is social support. The receiver conducts a behaviour and the provider tries to control this behaviour. For adults in committed relationships, the partner or spouse is usually reported as the most important source of social control (August & Sorkin, 2010; Umberson, 1992).

Research on the relationship between social control and health or health behaviour have shown mixed results (Lewis & Rook, 1999). The dual-effects model of social control (Hughes & Gove, 1981; Lewis & Rook, 1999; Okun, Huff, August, & Rook, 2007) proposes two coincidental effects of social control: social control is supposed to have positive effects on the health behaviours of the controlled person, whereas at the same time it is supposed to enhance the distress of the receiver due to perceived criticism, for example. Studies on the relationship between social control and distress resulted in mixed findings; some showed more distress in controlled individuals (e.g., Lewis & Rook, 1999) while others showed less distress in controlled individuals (Rook, Thuras, & Lewis, 1990). The relationship between social control and health
behaviours is also ambiguous. Some studies have reported positive relationships between social control and health behaviour or less harmful behaviours (e.g., Lewis & Butterfield, 2007; Umberson, 1992) while others have reported the opposite: relations of social control with less health-enhancing behaviours or more health-compromising behaviours (e.g., Helgeson, Novak, Lepore, & Eton, 2004; Thorpe, Lewis, & Sterba, 2008). These relations of social control to worse health behaviours might be explained by reactance with actions such as pretending to perform the desirable behaviour or hiding the unwanted behaviour (e.g., Thorpe et al., 2008; Tucker, 2002).

The health behaviours which are examined in this thesis, namely nutrition behaviour and smoking, are among the most common behaviours which are aimed at change by applying social control. Lewis and Rook (1999) asked adults to report health behaviours which had recently been tried to be influenced or regulated by significant others. The most reported behaviour was social control aimed at reducing smoking or quitting completely. Among the ten most common behaviours were several regarding nutrition behaviour or factors related to being overweight such as exercising more, losing weight, eating a healthier diet (Lewis & Rook, 1999). As in general health behaviours, findings regarding social control and nutrition behaviour or smoking are also ambiguous.

In some studies social control was related to less smoking. Umberson (1992) showed that among married adults social control was associated with a subsequent decrease in cigarette smoking. Rook and colleagues (1990) found that older adults smoked fewer cigarettes if significant others regularly depended on them (as explained by a sense of social obligation, c.f. definition of indirect control previously addressed in this chapter). However, Westmaas, Wild, & Ferrence (2002) found gender differences: social influence was more helpful for men than for women to reduce smoking. For men, increased social control was associated with greater reduction in smoking two days and four months after the quit date, whereas for women social...
control was related to smaller reductions in smoking. Helgeson and colleagues (2004) even found social control from the spouse related to increasing health-compromising behaviours such as smoking.

Findings regarding smoking but also other health behaviours and social control point out that so far it is not clear if the effects of social control are more positive or negative overall. Moreover it remains open why and how these relations work or if other factors play a role. One such factor is the relationship satisfaction. Knoll, Burkert, Scholz, Roigas, and Gralla (2010) examined the dual-effects model of social control and integrated relationship satisfaction as a moderator of the association of spousal control with health behaviour and with affect. Individuals with a happy relationship benefited from spousal control whereas individuals who were less satisfied with their relationship did not benefit from control regarding health behaviour and also reported lower levels of positive affect when they received a lot of social control from the spouse (Knoll et al., 2010). Similarly, Okun and colleagues (2007) found relationship quality to be a moderator. Moreover, they tested four different models of the effect of health-related control and found at least some evidence for all four models indicating that several models may explain the multiple effects of social control.

2.3.3 The interplay of social control and social support in health behaviour change

As stated in the former chapter, studies examining the effects of social control on health behaviour change have shown mixed results (Lewis & Rook, 1999). Moreover, it remains unclear if other factors play a role. For example, relationship satisfaction was identified as an important factor (Knoll et al., 2010). The question raises, if there are other factors which determine when social control is beneficial in health behaviour change. This may be tested through moderator analyses. As stated above, moderator variables affect the direction or strength of the relationships
between two variables, in this case social control and health behaviour, and specify when this effect emerges. Regarding different social processes, social support seems to be a suitable moderator. Individuals in intimate relationships report receiving social control and social support. It seems common to experience both social processes, which are usually positively related, simultaneously (e.g., Franks et al., 2006; Khan, Stephens, Franks, Rook, & Salem, 2013). So far social support has been tested as a moderator on the relationship between social control and health behaviour change in the context of knee pain (Fekete, Stephens, Druley, & Greene, 2006) and physical exercise (Khan et al., 2013). Fekete and colleagues (2006) analysed the interplay of social control and social support in a sample of older adults who were recovering from knee surgery. The interaction between social support and control showed that high levels of social control combined with low levels of problematic support were beneficial with regard to patients’ adherence. The authors concluded that effectiveness of social control depended largely on the quality of social support (Fekete et al., 2006). As this study applied a cross-sectional design it remains unclear how joint effects of social support and control unfold over time and when focusing on change in health behaviour.

Khan and colleagues (2013) applied a diary design to explore the effects of social support and control on physical activity in older adults with Type 2 diabetes. Social support moderated the association between social control and energy expenditure the following day: an increase of social control was associated with an increase in energy expenditure when high levels of social support were also provided. In contrast, social control was not related to a change in energy expenditure the next day when social support was low (Khan et al., 2013). This study showed first evidence that the combination of high levels of social control and support are beneficial in health behaviour change. Taken together, the results suggest a synergistic effect of social control and social support. However, bearing in mind that these effects were explored in special samples
(i.e. adherence in patients after knee surgery, physical exercise in older adults with Type 2 diabetes), it remains unclear if this effect would also be found in other contexts.

2.4 The interplay of self-regulatory and social factors in health behaviour change

As described in chapter 2.2, individual self-regulation factors are important in health behaviour change. Several models explain how these factors predict behaviour. Besides self-regulatory factors, social processes are crucial too (see chapter 2.3). Moreover, many health-compromising behaviours, e.g., smoking, are caused by different factors such as physical, psychological, or social factors. Nevertheless most studies examine influences of individual psychological factors or of social factors. Studies that take self-regulatory and social factors or a combination of both into account are rare. Within the framework of the HAPA-model, a study in the context of nutrition behaviour (Scholz, Ochsner, Hornung, & Knoll, 2013) showed beneficial effects from received social support over and above self-regulatory factors. Studies examining self-regulation and adding social support as a predictor of intentions or behaviour within the framework of the theory of planned behaviour (Ajzen, 1991), social-cognitive theory (Bandura, 1977, 2001), or the transtheoretical model (Prochaska & DiClemente, 1983), resulted in mixed findings (e.g., Andersen, 2006; Anderson, Winett, & Wojcik, 2007; Hamilton & White, 2008; Strating, van Schuur, & Suurmeijer, 2006). In the context of healthy eating, social support was added as a moderator to the theory of planned behaviour (Povey, Conner, Sparks, Rhiannon, Shepherd (2000). Social support was tested as a moderator on the association between perceived behavioural control or attitude and intentions and was confirmed by the results. For the moderating effects of social support on the relationship between attitudes and intentions, a synergistic effect emerged. Attitudes were positively related to intentions at all levels of social support. As social support increased, the power of attitudes to predict intentions increased, too.
Regarding the relationship of perceived behavioural control and intentions, a different picture emerged. When social support was high, perceived behavioural control did not predict intentions. In contrast, when social support was low, behavioural control was a strong positive predictor of intentions (Povey et al., 2000). In the context of multi-morbid older adults, the interaction of self-efficacy and received social support regarding perceived autonomy was tested (Warner et al., 2011). For individuals with low levels of self-efficacy, social support was positively associated with perceived autonomy. This indicated that individuals compensated for their low levels of self-efficacy with received social support. In contrast, for individuals with higher levels of self-efficacy, higher levels of received social support interfered with perceived autonomy (Warner et al., 2011). These few prior studies on joint effects of social support and self-regulatory variables suggest synergistic or compensating effects.
3 Research Questions

The purpose of this thesis is to explore self-regulatory and social factors that are relevant in health behaviour change. Furthermore, combinations of these factors are examined. In this chapter the main research questions and foci of the three papers integrated in this thesis are described. Paper 1 examines self-regulatory factors of health behaviour change: the role of phase-specific self-efficacies in the context of nutrition behaviour. Paper 2 explores the combination of self-regulatory and social factors in the context of smoking cessation. Paper 3 examines joint effects of different social factors in smoking cessation.

3.1 Phase-specific self-efficacies in dietary behaviour change

Self-efficacy is regarded as a very important predictor in several models explaining health behaviour change (e.g., in the social-cognitive theory by Bandura, 1977, 2001; in the HAPA-model by Schwarzer, 1992, 2008). As described in chapter 2.2.1, self-efficacy is relevant in motivational and volitional phases of behaviour change and can be differentiated into phase-specific self-efficacies. With regard to nutrition behaviour and weight loss, self-efficacy is examined in most studies and is demonstrated as an important predictor (e.g., Contento, Randell, & Basch, 2002; Shaikh, Yaroch, Nebeling, Yeh, & Resnicow, 2008), but only few studies have examined self-efficacy as phase-specific in this context so far (Renner et al., 2008; Schwarzer & Luszczynska, 2008; Schwarzer & Renner, 2000; Schwarzer et al., 2007). These studies on phase-specific self-efficacies in the domain of nutrition assessed motivational factors (e.g., motivational self-efficacy or outcome expectancies) at baseline and volitional factors (e.g., volitional self-efficacy or behaviour) at a later follow-up. Motivational self-efficacy was related to intentions and volitional self-efficacy was associated with behaviour. These associations were all assessed cross-sectionally, so it remains unclear if these associations held across a temporal sequence (such as assessing motivational self-efficacy at baseline and intentions at a later follow-up).
Furthermore, none of these studies tested the predictive power of the phase-specific self-efficacies in competition with each other. Hence the unique predictive power of the self-efficacies also remains unclear. According to the theory phase-specific self-efficacies should be relevant only in the corresponding phase and should not have an effect in other phases. These assumptions can be tested by moderator analyses, applying phase indicators as moderators. Some studies and models (e.g., the TTM-model by Prochaska & DiClemente, 1983) have suggested past behaviour as phase indicator for being in the maintenance phase of behaviour change, e.g., a study by Scholz, Sniehotta, and Schwarzer (2005) demonstrated for the context of physical exercise that individuals who have already started the behaviour benefited from volitional self-efficacy as they were in the maintenance phase of behaviour change, whereas individuals who had not already started did less benefit from volitional self-efficacy (Scholz et al., 2005). Other approaches suggest intentions as phase indicators for being in the motivational or volitional phase of behaviour change (e.g., the HAPA-model by Schwarzer, 1992, 2008; the rubicon model by Heckhausen, 1977, 1991). Comparing these approaches, the different functions of intentions and past behaviour are relevant. The latter indicates allocation to the maintenance phase of behaviour change (Scholz et al., 2005), whereas intentions differentiate between allocation to the motivational or the volitional phase of behaviour change. One study has so far tested intentions as a moderator in the context of healthy eating (Renner & Schwarzer, 2005). Participants were separated into two groups: one with low intentions (non-intenders) and one with high intentions (intenders) to eat healthily. Different prediction patterns of nutrition were found between these two groups regarding self-efficacy as well as outcome expectancies and risk awareness. The findings are limited by the cross-sectional design. Furthermore this study did not test moderating effects of intentions on the associations between phase-specific self-efficacies and nutrition. This approach was applied in first paper of this thesis.
In *paper 1*, phase-specific self-efficacies are examined in the context of dietary behaviour change in a longitudinal design and in a sample with overweight or obese individuals (see chapter 5). As the above mentioned open questions show, so far no previous study has tested if the association between phase-specific self-efficacies and nutrition behaviour depends on the levels of intentions. The following research questions and hypotheses were investigated:

A) Do phase-specific self-efficacies play a unique role in the process of nutrition behaviour change?

Hypothesis 1: The phase-specific distinction of self-efficacy shows sufficient discriminant validity.

Hypothesis 2: Motivational self-efficacy is a stronger predictor of behavioural intentions six months later than volitional self-efficacy (when controlling for the effects of the HAPA-variables risk awareness and outcome expectancies).

Hypothesis 3: Volitional self-efficacy is a stronger predictor of low-fat dietary intake six months later compared to motivational self-efficacy (when controlling for the effects of the HAPA-variables action planning, action control, and behavioural intentions).

B) Do behavioural intentions as phase indicators moderate the association between volitional self-efficacy and nutrition behaviour change six months later?

Hypothesis 4: Behavioural intentions moderate the association between volitional self-efficacy and low-fat dietary intake six months later. Volitional self-efficacy is more beneficial for individuals with high levels of behavioural intentions than for individuals with low levels of behavioural intentions regarding low-fat dietary intake.
3.2 The interplay of self-regulatory and social factors in smoking cessation

As described in chapter 2.2 and indicated by the previous research questions, individual self-regulation factors are important in health behaviour change. In smoking cessation or the reduction of the number of daily smoked cigarettes, self-efficacy especially seems to be a crucial predictor (e.g., Gulliver et al., 1995; Gwaltney et al., 2009; Schwarzer & Luszczynska, 2008). Intentions, action and coping planning are further relevant factors in smoking behaviour (Hoving, Mudde, & de Vries, 2006; van Osch, Lechner, Reubsaet, Wigger, & de Vries, 2008; Schwarzer & Luszczynska, 2008). Besides self-regulatory factors, and as described in chapter 2.3., social factors are relevant in smoking cessation too, and can be helpful in different aspects of change in smoking behaviour (e.g., Carlson, et al., 2002; Gulliver et al., 1995; Park et al., 2004). Although self-regulatory and social factors are both well-known in smoking cessation and health behaviour change in general, studies rarely examine the joint influences of self-regulatory and social factors. As described in chapter 2.4., the few studies combining individual and social factors in health behaviour change suggest compensating or synergistic effects (e.g., Povey et al., 2000; Warner et al., 2011). In the context of smoking cessation a compensating function of social support for lower individual self-regulation can be proposed for the following reasons: first of all, partners or spouses know their smoking partner’s deficits in self-regulation best (e.g., Sillars & Scott, 1983) and thus social support could compensate for this weakness in self-regulation. Secondly, trying to quit is a very stressful situation for smokers (McMahon & Jason, 1998) and is probably even worse for smokers with lower individual resources. Social support could buffer some distress and might be most helpful for individuals with low self-regulation abilities, because they need support the most. Arguments for suggesting a synergistic effect in smoking cessation lie in the fact that smoking cessation is very difficult, as is indicated by high relapse rates (Hughes, Keely, & Naud, 2003). Therefore, self-regulation itself might not be sufficient, because both self-
regulation skills and social support are necessary to be able to quit smoking successfully. As no study has tested these combined effects of individual self-regulation and social support in smoking cessation so far, this was the aim of paper 2. Because synergistic or compensating effects would be reasonable, this was tested as competing hypothesis. As self-regulation factors volitional self-efficacy, action and coping planning were examined along with social support from the partner or spouse as a social factor, yielding the following research questions and hypotheses:

A) Do the examined self-regulatory and social factors have main effects on smoking cessation?

Hypothesis 1: The factors of individual self-regulation, volitional self-efficacy, action planning and coping planning, have positive main effects on smoking cessation.

Hypothesis 2: The social factor, i.e. received social support from the partner, has a positive main effect on smoking cessation.

B) Do joint effects of social support and the factors of individual self-regulation emerge with regard to smoking cessation?

Hypothesis 3: Joint effects emerge of social support and volitional self-efficacy / action planning / coping planning with regard to smoking cessation.

Hypothesis 4: These interactions indicate compensating or synergistic effects.

### 3.3 Joint effects of different social factors in smoking cessation

As described in chapter 2.3.1, social support is an important factor for health behaviour and was also demonstrated as moderating effect in health behaviour change. Besides social support, social control is also considered a relevant social factor in the initiation and maintenance
of health behaviours (see chapter 2.3.2). Compared to social support, effects of social control are
less clear and seem to be rather a mixed blessing (Lewis & Rook, 1999). Married individuals
report their spouses to be the most important source of social control and support (Schwarzer &
Gutierrez-Dona, 2005; Umberson, 1992); thus it seems common to receive support and control
from one’s partner (e.g., Franks et al., 2006; Khan et al., 2013). Nonetheless, the influences of
social support and control have mostly been examined separately (see chapter 2.3.3). Only a few
studies have explored whether joint effects of support and control exist in health behaviour
change and if so, how they unfold (Fekete et al., 2006; Khan et al., 2013). As described in chapter
2.3.3, concluding the results of the few studies on joint effects of social support and control, a
synergistic effect is suggested. The aim of the third paper was to examine whether social support
and control from the partner interacted with regard to smoking cessation and whether this
interaction indicated a synergistic effect. The following research questions and hypotheses were
investigated:

A) Do the examined social factors have main effects on smoking cessation?

Hypothesis 1: Social control, received from the partner, has a positive or negative main effect on
smoking cessation.

Hypothesis 2: Social support, received from the partner, has a positive main effect on smoking
cessation.

B) Do joint effects of social control and social support emerge with regard to smoking
cessation?

Hypothesis 3: Joint effects emerge of social control and social support on smoking cessation.

Hypothesis 4: The interaction indicates a synergistic effect.
To answer the research questions described in this chapter, data was collected in two larger studies: one with a sample of overweight or obese individuals regarding nutrition behaviour and one regarding smoking cessation with a sample of heterosexual couples with a smoking and a non-smoking partner. Both studies will be described in the next chapter.
4 Description of the Studies

In this chapter the two studies are presented, which provided data for the three papers. The “nutrition study” refers to the research questions in chapter 3.1, which were answered in *paper 1*. The “direct study” covers the research questions in chapter 3.2 and 3.3, referring to *paper 2* and *paper 3*. In this chapter the study designs and samples are described. The complete method sections are presented in the corresponding paper in chapters 5, 6, and 7.

4.1 Nutrition study

The nutrition study (management: Prof. Dr. Urte Scholz) was conducted as a single-blind randomised controlled trial. It was funded in part by the “Stiftung Suzanne und Hans Biaesch zur Foerderung der Angewandten Psychologie”. The main purpose was to evaluate the effects of different planning interventions on long-term changes in nutrition behaviour and social-cognitive variables. As described in chapter 2.3, repeated formation of action and coping plans is related to long-term effects in health behaviour change, but it is unclear which quantity of plans would be most beneficial. This was tested in the nutrition study, as different intervention groups with different number of action and coping plans were compared (see Scholz, Ochsner, & Luszczynska, 2013). The study was advertised in newspapers and on websites to get in touch with overweight or obese individuals from the general Swiss population. The advertisement stated that a scientific study by the University of Zurich on change in diet was looking for participants who want to reduce their weight by changing their nutrition to a low-fat diet. Inclusion criteria were intention to change one’s diet, being overweight or obese (BMI above 25) and being at least 18 years old. Exclusion criteria were insufficient comprehension of the German language and participating in a professional weight loss programme (e.g. Weight Watchers). The
study included baseline assessment at the university and follow-ups after four, six and twelve months (see Figure 2).

![Figure 2. Study design of the nutrition study](image)

Participants were randomly allocated to the control or an intervention group (single-planning intervention group, three-, six- or nine-weeks planning intervention group). After completion of the study participants received a reimbursement of 50 Swiss Francs. Participation was voluntary and all participants were treated in accordance with the ethical guidelines of the Helsinki Declaration 2000. At baseline, participants received information about the study and the procedure and signed an informed consent form. They were then given educational leaflets about a healthy and low-fat diet which was based on the guidelines of the Swiss Society for Nutrition (SSN). Afterwards, participants completed a quiz on knowledge about low-fat nutrition, discussed their answers and were shown the correct answers by a trained interviewer. The participants completed a questionnaire including demographic variables, social-cognitive variables, nutrition behaviour, weight and height. Thereafter a 24-hour recall was conducted as a
face-to-face interview with a trained interviewer to assess the total amount of food intake during the previous 24 hours. For participants in the control group, the baseline assessment was completed whereas participants of all intervention groups received a face-to-face planning intervention (adopted from Sniehotta, Scholz, & Schwarzer, 2006). Participants formed up to three action and up to three coping plans with the assistance of a trained interviewer. The structure for action plans was when, where and how and for coping plans what personal risk situation and how do you overcome this situation?. An example of an action plan is “At lunchtime (when) in the cafeteria at my workplace (where) I am going to eat a salad with some whole-grain bread (how)” and for a coping plan “If I want to eat a dessert after lunch (what personal risk situation) I am going to eat some fruit instead (how do you overcome this situation)”.

Participants of the single-planning intervention group received this planning intervention only once. Participants in the three weeks-, six weeks or nine weeks-planning intervention group received further interventions during three, six, or nine weeks respectively. These interventions were not face-to-face but participants received three, six or nine planning sheets to complete by themselves at home once a week and return them via mail (Scholz, Ochsner, & Luszczynska, 2013).

The follow-up applied the same procedure for participants in the control and in all the intervention groups. They were mailed questionnaires and material for the 24-hour recall together with stamped return envelopes. The 24-hour recalls were conducted as telephone interviews.

The sample consisted of 373 participants at baseline, including 270 women (72.4%). The mean age was 52.42 years (SD = 12.79), ranging from 18 to 82 years and the mean BMI was 31.05 (SD = 4.41), indicating that the average participant was obese. The majority of the participants had children (n = 261, 70%) and were married or in a committed relationship (n = 261, 70%).
247, 66.2%), 58 participants (15.5%) were divorced, 51 were single (13.7%), 16 were widowed (4.3%), and one participant did not report the marital status (0.3%). Most participants were currently employed \( (n = 226, 60.6\%) \) and had attended nine years of schooling \( (n = 231, 61.9\%) \), indicating an average educational level of the sample. Dropout ranged between 25.5% and 27.6% across all follow-up questionnaires. In paper 1 the data from baseline and the six-month follow-up was analysed (see chapter 5).

### 4.2 Direct study

The “Dyadic and Individual Regulation to End Chronic Tobacco Use” project (direct study) was conducted as a longitudinal study. It was funded by the “Swiss National Science Foundation” (SNF, project number 100014_124516, principal investigator: Prof. Dr. Urte Scholz, co-investigator Prof. Dr. Rainer Hornung). The main purpose was to explore dyadic and individual factors in smoking cessation in a sample of heterosexual couples with a smoking and a non-smoking partner. As described in chapter 3.1, individual self-regulation and social factors are known to be beneficial in health behaviour change, but these two lines of research have rarely been combined. In the direct study the unique and joint effects of different self-regulatory and social factors were analysed regarding smoking cessation.

The study was advertised in newspapers and on websites to reach smoker-non-smoker-couples from the general population. Because the recruiting process had been very difficult, a marketing research institution was included. Inclusion criteria for the couples were being in a committed relationship or married for at least a year, cohabiting for at least six months and being 18 years old or older. Exclusion criteria were working in shift work, being pregnant and insufficient comprehension of the German language. Further criteria for the smoking partner were smoking at least one cigarette a day (in line with the definition of daily smokers by the WHO, 1998), wanting to quit smoking and not participating in any professional programme on smoking
cessation. Further criteria for the non-smoking partner were that he/she never smoked or quit smoking at least five years before. Study participation was voluntary and all participants were treated in accordance with the ethical guidelines of the Helsinki Declaration 2000.

The study design started with a run-in (T0) prior to the baseline assessment (T1, see Figure 3).

![Figure 3. Study design of the direct study](image)

Thereafter the self-set quit date of the smoking participants followed, on average 29 days after the quit date a follow-up (T2) was conducted and six months after the quit date the final follow-up (T3) was done. Additionally, a diary phase with 32 diary days between T1 and T2 (starting 10 days before the quit date and ending 21 days after the quit date) was completed. The run-in (T0) consisted of a questionnaire (assessing socio-demographic variables and a first assessment of some self-regulatory and social factors) which was emailed to the participants and completed online. The baseline assessment and the two follow-ups took place at the University of Zurich. At baseline (T1) all participants received information about the study and the procedure,
provided informed consent and received a personal code to ensure anonymity. After that, the smoking partner announced the self-set quit date which was on average 17 days (range 8 – 39 days) after T1 and his/her smoking status was assessed as self-report and objectively measured. Both partners completed a questionnaire (on individual self-regulation and social factors and on smoking behaviour). Finally, they received smartphones to be able complete the diary questionnaires via smartphone at home. They were instructed to answer the question via smartphone every day before bedtime for 32 days. The smartphones were returned at the follow-up (T2) which was on average 29 days (range 21 – 58 days) after the quit date and approximately seven weeks after T1. At T2 all participants completed questionnaires and the smoking status of the smoker was measured objectively again. Each couple received 100 Swiss Francs after finishing T2. Six months after the quit date participants returned to the university for the last follow-up (T3), undergoing the same procedure as at T2 and again receiving 100 Swiss Francs.

The smoking status of the smoking partner was assessed via self-report and additionally measured objectively with biochemical verification. The latter was done with a carbon monoxide test (CO) of expired air (West, Hajek, Stead, & Stapleton, 2005) using the Smokerlyzer (Bedfont Instruments, Harrietsham, UK). The carbon monoxide test was chosen because it is non-invasive, valid and not biased by the use of nicotine replacement products as other biochemical verification test (e.g., salivary cotinine samples) are.

The sample consisted of 106 smoking participants and their heterosexual non-smoking partners at baseline. Of the smokers 77 were men (72.6%) and they were on average 40.67 years old ($SD = 10.03$), ranging from 19 to 72 years. The non-smoking partner were on average 38.97 years ($SD = 9.86$), ranging from 20 to 63 years. The majority of the couples were married (65.1%) and had children (58.5%). According to the inclusion criteria, unmarried couples reported a committed relationship and were cohabiting. The average duration of the relationships
was 161.47 months ($SD = 112.66$, ranging from 14 to 480 months), and of cohabiting 137.87 months ($SD = 113.41$, ranging from 6 to 480 months). In large parts, smoking partners were currently employed ($n = 86, 81.1\%$) and reported having attended 9 years of schooling ($n = 75, 70.8\%$) indicating an average educational level. They smoked on average 16.59 cigarettes daily ($SD = 8.52$, range 1-40) at baseline and the majority had a strong intention to quit smoking (c.f. chapter 6).

Overall dropout rates were low. Of the initial 106 participating couples, 99 couples (93.4%) completed the T2 follow-up and 98 (92.5%) the T3 follow-up. In paper 2 and paper 3, data from the smoking partners at baseline and the first follow-up was analysed (see chapter 6 and 7).
5  Paper 1: Testing Phase-specific Self-efficacy Beliefs in the Context of Dietary Behaviour Change

By Sibylle Ochsner, Urte Scholz, & Rainer Hornung

A similar version of this chapter is published:

6 Paper 2: The Interplay of Received Social Support and Self-regulatory Factors in Smoking Cessation

By Sibylle Ochsner, Aleksandra Luszczynska, Gertraud Stadler, Nina Knoll, Rainer Hornung, & Urte Scholz (2014)

A similar version of this chapter is published:

Paper 3: Joint Effects of Received Social Control and Social Support in Smoking Cessation

A similar version of this chapter is submitted for publication (Ochsner et al., submitted).
Abstract

Objective: Social control and social support are known to have positive effects on smoking cessation. However, as these two processes of social exchange are mostly examined separately, the present research aimed at investigating the interacting effects of smoking-specific received social control and support in smoking cessation over time. The study tested the hypothesis that the combination of high levels of social control and support from a partner would be most beneficial for smoking cessation, indicating a synergistic effect.

Methods: The sample consisted of 99 smokers. Received social control and received social support were measured at baseline. Seven weeks after baseline and on average 29 days after the self-set quit date, smoking cessation was assessed objectively.

Results: Received social support moderated the association between received social control and smoking cessation. The hypothesized synergistic effect emerged only for few individuals reporting very high levels of social support and control. For individuals reporting average or lower levels of social support, lower levels of social control were beneficial regarding smoking cessation.

Conclusions: Results indicate that for successful smoking cessation, partners should either provide very high or rather low levels of both, received social support and social control.

Keywords: social control, social support, smoking cessation, health-behaviour change
Introduction

Social exchange processes, such as social support and social control, are often assumed to positively affect behaviour change. Received social support comprises retrospective reports of actual support transactions, such as being comforted (Schwarzer & Knoll, 2010). Social control, in contrast, refers to strategies that aim at regulating or influencing the behaviour of the receiver, regardless of his/her own intentions. Control includes strategies like making suggestions or expressing positive emotions (Lewis & Rook, 1999). These different functions of social support and control allow receiving both at the same time and indeed they seem to co-occur as they are usually positively related (e.g., Khan et al., 2013). For married individuals, it seems to be common to experience support and control from their spouse, as the spouse is reported as the most important source of social control and social support (Schwarzer & Gutierrez-Dona, 2005; Umberson, 1992). Nonetheless only a few studies so far explored whether or not there are joint effects of support and control on health behaviours and if so how they unfold (Fekete et al., 2006; Khan et al., 2013).

In the context of knee surgery, Fekete et al. (2006) found no main effects of spousal social support or control on adherence. The interaction between support and control, however, showed that a combination of high levels of positive spousal control together with low problematic support was beneficial for adherence (Fekete et al., 2006). Due to the cross-sectional design, however, it remains unclear how joint effects of support and control unfold over time. Applying a daily diary design, Khan et al. (2013) found that spousal support moderated the association between spousal control and energy expenditure the next day. Spousal control was associated with an increase in energy expenditure when spouses also provided high levels of social support. In contrast, control was not associated with change in energy expenditure when social support was low (Khan et al., 2013). Taken together, results hinted at a synergistic effect of social control
and social support. Whether this also applies in the process of smoking cessation, was examined in the current study.

Smoking causes an increased risk for many diseases such as stroke, cancer, or cardiovascular disease (Mokdad et al., 2004, 2005). Social support and control can have positive effects on smoking cessation (e.g. Park et al., 2004; Umberson, 1992; Westmaas et al., 2002), but evidence is mixed, especially with regard to social control (Lewis & Rook, 1999). So far, in the context of smoking cessation, effects of social control and social support were analyzed separately. Thus, in accordance to recent results by Fekete et al. (2006) and Khan et al. (2013), this study aimed at examining whether social support and social control together result in a synergistic effect with regard to smoking cessation.

Method

Design and Participants

This study was part of a larger longitudinal study[^1], “Dyadic and Individual Regulation to End Chronic Tobacco Use (DIRECT)”, funded by the Swiss National Science Foundation (100014_124516). Eligibility criteria included smoking at least one cigarette daily (according to the definition of daily smokers by the World Health Organization, 1998) and cohabiting with a non-smoking partner or spouse of the opposite sex. At baseline (T1), participants completed a questionnaire and announced their self-set quit date, which was on average 17 days after baseline. The second point of measurement (T2) took place on average 29 days after the quit date. At T2 participants again completed a questionnaire and their smoking status was biochemically verified. At baseline, the sample consisted of 106 participants. The average number of daily smoked cigarettes at T1 was 16.59 (SD = 8.52, range 1-40). Participants were on average 40.67 years old (SD = 10.03) ranging from 19 to 72 years, and 72.6% (n = 77) were men. At T2, 99 participants
(93.4%) took part at the follow-up. For more detailed information on the recruitment of the study design, sample and drop out, see Ochsner and colleagues (2014).

**Measures**

Social control and support were assessed at T1 and smoking cessation at T2.

*Smoking-specific received social control* ($M = 1.47$, $SD = 0.50$, Cronbach’s Alpha = .69) was assessed with four items (adapted from Butterfield & Lewis, 2002). Participants were asked how often their partner tried to influence their smoking behaviour in the past seven days. An example item is: “My partner tried to influence my smoking behaviour by making suggestions how to reduce smoking or how to quit.” The response format was a four-point scale ranging from $1 = \text{rarely or none of the time (less than 1 day)}$ to $4 = \text{mostly or all of the time (5-7 days)}$.

*Smoking-specific received social support* ($M = 3.64$, $SD = 1.04$, $\alpha = .76$) was measured with four items (Burkert et al., 2005). Participants were asked to think of their partner and how he/she reacted with emotional support to the participant in the past seven days. An example item is: “My partner comforted me when I was feeling bad because I could not smoke.” The response format was a six-point scale ranging from $1 = \text{completely disagree}$ to $6 = \text{completely agree}$.

*Smoking cessation* was assessed objectively with biochemical verification of *point prevalence of abstinence* at T2. A carbon monoxide test (CO) of expired air was conducted with the Smokerlyzer (Bedfont Instruments, Harrietsham, UK). The recommended cut-off point is 9 parts per million (p.p.m., West et al., 2005). Thus participants were categorized as $0 = \text{smoking (}> 9 \text{ p.p.m.) versus } 1 = \text{abstinence (} \leq 9 \text{ p.p.m., indicating successful smoking cessation)}$.

**Data Analyses**
Data was mostly complete (at T1 less than 4% missing values, at T2 less than 8%) and no significant difference in number of daily smoked cigarettes at T1 for dropouts and completers emerged. Thus missing values were treated by using listwise deletion (Graham, 2009). Analyses were conducted with IBM SPSS 20. Main analyses were logistic regression models. Predictors were mean-centered and results were displayed in Figure 7 according to Dawson (2013). The Johnson-Neyman technique was applied to test the region of significance, indicating the range of the moderator within which the simple slope of the dependent variable on the predictor is significantly different from zero (Hayes & Matthes, 2009).

Results

Point prevalence of abstinence resulted in 67 (63.2%) abstinent participants at T2. Sex and age were tested as covariates. Bivariate correlations showed that both were not significantly correlated to point prevalence of abstinence and thus were not included in the analysis.

A logistic regression analysis was conducted to test whether smoking-specific received social support moderated the association between smoking-specific received social control and point prevalence of abstinence (see Table 9). No main effects of social control or social support emerged but the interaction between these two variables was significant. This interaction was further investigated by testing the region of significance by applying the Johnson-Neyman technique. It resulted in boundaries of -1.05 and 1.79 ($p < .05$), indicating that the association between social control and point prevalence of abstinence was significant at levels of mean-centered social support lower than -1.05 and higher than 1.79 ($p < .05$). Considering that the minimum and maximum of the mean-centered social support were -2.64 and 2.11, respectively, the association between social control and point prevalence of abstinence was only significant for individuals with relatively low levels or very high levels of social support but not for average high levels of social support. For individuals with lower levels of social support it was beneficial.
to also have lower levels of social control with regard to point prevalence of abstinence (see Figure 7). For individuals reporting very high levels of social support the combination of high levels of social control and social support was beneficial regarding smoking cessation, indicating a synergistic effect. However, this synergistic effect was found only for a minority of the participants. More precise, the effect was mainly driven by individuals reporting low levels of both, social control and social support.

Table 9.

*Prediction of point prevalence of abstinence at T2 by social control moderated by social support*

<table>
<thead>
<tr>
<th></th>
<th>Point prevalence of abstinence at T2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$b$</td>
<td>SE $b$</td>
<td>Odds ratio</td>
</tr>
<tr>
<td>Constant</td>
<td>.58</td>
<td>.24</td>
<td>1.78*</td>
</tr>
<tr>
<td>Received social control</td>
<td>-.34</td>
<td>.51</td>
<td>.71</td>
</tr>
<tr>
<td>Received social support</td>
<td>-.25</td>
<td>.26</td>
<td>.78</td>
</tr>
<tr>
<td>Social control x social support</td>
<td>1.43</td>
<td>.64</td>
<td>4.16*</td>
</tr>
</tbody>
</table>

*Note. N = 95. * $p < .05$. |

Discussion

This study aimed at exploring the role of smoking-specific received social control in combination with smoking-specific received social support in the process of smoking cessation. In particular, we tested for synergistic effects of the two exchange processes in order to examine when social control is beneficial and when it is not. To our knowledge, it is the first longitudinal study examining the joint effects of social control and support in the context of smoking cessation.

No direct effects of social control or received support on smoking cessation were found, but the interaction term of these two variables emerged as a relevant predictor. For individuals reporting low levels of social support, the combination with low social control was beneficial. In contrast, for individuals with high levels of social support high levels of social control were
beneficial, albeit this effect emerged only for few individuals with very high levels of social support. Therefore the results were only partly in line with those from Kahn et al. (2012) and our synergistic hypothesis could not be confirmed for the most part. However, the findings indicated that social support seems like a basis for the combination with social control. If support is low, control is rather non-constructive and only if support is very high, control is beneficial.

Social control is often assumed to relate to better health-behaviour (e.g., Umberson, 1992), but observed effects are less than consistent (Lewis & Rook, 1999). Our findings indicate that high received social support may buffer potential costs of social control in smoking cessation. Importantly, low levels of support are better complemented with low levels of control rather than with higher levels of control.

Limitations of the study relate to the specific couple constellation: The sample consisted of smokers who cohabited with their non-smoking partner of the opposite sex. Thus, generalisability of the results might be limited, for example regarding couples with both partners smoking or same-sex couples. Replications should explore gender differences and effects on affect as these are often found in studies assessing social control or support (e.g. Lewis & Rook, 1999; Westmaas et al., 2002). Despite these limitations, this study was the first to indicate that the effectiveness of social control on success in smoking cessation depends on the levels of social support received at the same time.
Footnote

As this study was part of a larger longitudinal study, parts of the data analyzed in this paper were also used in a paper by Ochsner et al. (2014) about the interplay of social support and individual self-regulation variables. Although there is some overlap in the variables used, the present paper investigates a unique research question and displays results not yet covered by previous publications from the larger project.

Acknowledgement

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8 Discussion

Overweight and smoking are the two leading causes of preventable deaths (Mokdad et al., 2004, 2005). It is therefore crucial to investigate and understand determinants and correlates of successful smoking cessation and change in nutrition behaviour. In these two specific examples as well as in health behaviour change in general, several studies have demonstrated that individual self-regulation (especially self-efficacy) and social factors (especially social support) have played an important role. Although self-regulatory and social factors have a long tradition of research, these two lines of research have rarely been combined to investigate joint influences on health behaviour change. Moreover, regarding social factors there is also a lack of exploring combinations of different social factors. Therefore, the main purposes of this dissertation were the following: firstly, to examine self-efficacy as a factor of individual self-regulation in the context of change in nutrition behaviour; secondly, to combine the two lines of research, namely individual self-regulation and social support as a social factor, in the context of smoking cessation and thirdly, to investigate how different social factors, namely social support and social control, interact with one another with regard to smoking cessation.

In this chapter the major results of the three papers will be summarised and discussed. Thereafter, a discussion of methodological aspects, including the studies’ research design, samples, measures, and the applied theoretical framework follows. Limitations and strengths and implications for future research and practical recommendations will then be presented. Finally, general conclusions will be drawn.

8.1 Discussion of the major results

In this section the major results of the two studies will be summarised and discussed. More detailed results can be found in the corresponding papers described in chapters 5, 6 and 7.
8.1.1 Nutrition study – self-efficacy in dietary behaviour change

Data from the nutrition study is presented in paper 1 (see chapter 5) which explored the role of a resource of self-regulation, namely self-efficacy, in the context of nutrition behaviour. The first aim of the study was to test the hypothesis that the proposed phase-specific distinction showed sufficient discriminant validity. Secondly, the hypothesis was examined that motivational self-efficacy was, compared to volitional self-efficacy, a stronger predictor of behavioural intentions after six months and thirdly, that volitional self-efficacy was, compared to motivational self-efficacy, a stronger predictor of nutrition behaviour, namely low-fat dietary intake, after six months. Fourthly the hypotheses was tested that behavioural intentions moderate the association between volitional self-efficacy and low-fat dietary intake six months later (indicating that intentions work as a phase allocator). These hypotheses were investigated within the framework of the HAPA-model and on the basis of a sample of overweight or obese individuals.

Regarding the first hypothesis, results confirmed the distinction of two phase-specific self-efficacies in the context of nutrition behaviour: motivational and volitional self-efficacy. Former studies which investigated self-efficacies in the context of nutrition behaviour (Renner et al., 2008; Schwarzer & Luszczynska, 2008; Schwarzer & Renner, 2000: Schwarzer et al., 2007) proposed phase-specific distinction as well, but did not test specifically whether this distinction showed sufficient discriminant validity. Studies in the context of physical exercise in cardiac rehabilitation (Scholz et al., 2005) or in pelvic-floor exercise after prostatectomy (Burkert et al., 2012) demonstrated discriminant validity for three or four phase-specific self-efficacies. It therefore remains unclear how many phase-specific self-efficacies, and thus how many different phases in the process of behaviour change, should be taken into account in health behaviour change, which should be tested in future studies.
Regarding the second and third hypotheses, results demonstrated that according to our assumptions motivational self-efficacy but not volitional self-efficacy predicted intention six months later. As the majority of former studies applied a cross-sectional design in assessing motivational self-efficacy and intention (e.g., Schwarzer et al., 2007) or showed no association between the two (Burkert et al., 2012), paper 1 of this thesis was the first to demonstrate the unique predictive validity of motivational self-efficacy predicting intentions at a later point in time. Regarding the prediction of nutrition behaviour, motivational self-efficacy did not emerge as a predictor, which had been expected, but unexpectedly neither did volitional self-efficacy. This was also in contrast to prior studies which demonstrated volitional self-efficacy as a predictor of health behaviour assessed at the same time (e.g., Luszczynska & Schwarzer, 2003; Renner et al., 2007) or across time (Scholz et al., 2005). One possible explanation why volitional self-efficacy did not predict nutrition behaviour in the current study may lie in the long time span between the assessments. The study focused on an outcome measured six months after baseline and did not consider changes in the predictors. It may therefore be possible that baseline measures of the predictor variables changed during these six months. Future research should address this issue by adding a micro-time perspective in assessing daily or weekly measures during a time span between the long-term follow-ups or take changes of the predictors into account (e.g., Freund & Hennecke, 2012; Kiene, Tennen, & Armeli, 2008; Scholz et al., 2009). Another explanation is provided by the theoretical question of whether volitional self-efficacy is relevant in behaviour which is performed several times a day, such as nutrition. Do such behaviours still need to be actively maintained, or are they habituated after some time and no longer require volitional self-efficacy (see e.g., Brug, de Vet, de Nooijer, & Verplanken, 2006; Norman, 2011)? To answer this question, future studies should include processes such as habituation and disengagement. In the present study no main effect from volitional self-efficacy
Discussion

on nutrition behaviour was found, but the association was explored with a moderator analysis. According to the assumptions, intentions moderated the relationship between volitional self-efficacy and nutrition behaviour, and not between motivational self-efficacy and behaviour. The significant interaction between volitional self-efficacy and intentions showed that, as hypothesized, individuals with high levels of intention benefited more from volitional self-efficacy regarding nutrition behaviour, whereas individuals with low levels of intentions benefited less. Hence, intentions can be regarded as a phase allocator showing whether individuals are in the motivational (low levels of intention, no benefit from volitional self-efficacy) or the volitional phase (high levels of intention, benefit from volitional self-efficacy) of behaviour change. The current study was the first to demonstrate the moderating role of intentions regarding the association of volitional self-efficacy and behaviour, but is in line with former studies that investigated other phase allocators as a moderator of the association between phase-specific self-efficacies and phase-specific outcomes (e.g., Burkert et al., 2012, Scholz et al., 2005). These results combined show that phase-specific self-efficacies unfold their relevance uniquely in the corresponding phase of behaviour change.

Overall, paper 1 demonstrated that self-efficacy, as a resource of self-regulation, plays an important role in the context of nutrition behaviour change. Moreover, the differentiation between motivational and volitional self-efficacy and their relevance in different phases of behavioral change was supported.

8.1.2 Direct study – interplay of self-regulatory and social factors in smoking cessation

Data from the direct study was analysed in paper 2 and paper 3 (see chapters 6 and 7). In this section, the results of the second paper are discussed. The main purpose was to examine unique and joint effects of self-regulatory factors and social factors in the context of smoking
cessation. The HAPA-model was applied as the theoretical background model regarding individual self-regulation. An inclusion criterion in the study was the intention to quit smoking, which was indeed very high in the majority of participants. Therefore it can be assumed that the smokers were in the volitional phase of behaviour change (i.e. a strong intention had already been built). Hence, as self-regulatory factors only factors which are, according to the HAPA-model, relevant in the volitional phase of behaviour change were examined: volitional self-efficacy, action planning and coping planning. Received social support was chosen as a social factor. The first aim of the study was to test the hypothesis that the factors of self-regulation (volitional self-efficacy, action planning and coping planning) had unique effects on smoking cessation and the second hypothesis that received social support showed such an effect. Moreover, as third and fourth hypotheses it was examined if joint effects of social support with volitional self-efficacy / action planning / coping planning emerged and if they displayed as compensating or synergistic effects.

Regarding the first and second hypothesis, results showed neither main effects of social support nor volitional self-efficacy, action planning or coping planning with regard to smoking cessation. Prior studies applying the HAPA-model in the context of smoking behaviour showed mixed results. Scholz and colleagues (2009) found no association between action planning and smoking; volitional self-efficacy and coping planning were not assessed. Radtke, Scholz, Keller, and Hornung (2012) demonstrated a negative association between volitional self-efficacy as well as planning and the number of daily smoked cigarettes assessed at the same time point. Schwarzer and Luszczynska (2008) found the same associations across a time-span of five months. One possible explanation why volitional self-efficacy, action and coping planning did not predict smoking across time in the current study may lie in the different assessments of smoking behaviour. Radtke and colleagues (2012) and Schwarzer and Luszczynska (2008) both
assessed smoking behaviour as the number of cigarettes smoked per day, whereas in the current study successful smoking cessation, which is a stricter measure of smoking behaviour, was analysed. Another explanation may lie in the study design. The self-regulatory factors were assessed at baseline, prior to the smoking cessation date whereas smoking cessation was biochemically verified at the follow-up. It is possible that these factors changed during this time span, for example after the smoking cessation date but such changes were not taken into account.

Regarding received social support, no main effects were found on smoking cessation. This is in contrast to prior studies which demonstrated beneficial effects of receiving social support (e.g., Carlsen et al., 2002; Park et al., 2004). An explanation why the current study did not find a main effect of received social support may lie in the different study designs: in the prior studies mentioned, social support was integrated in intervention programmes on smoking cessation, whereas in the current study self-quitters who did not take part in any intervention were analysed. A study by Gulliver and colleagues (1995) investigated the effects of perceived social support on lapses across time in self-quitters. Perceived social support which was assessed 7 days after the quit date predicted lapses for the time period of 8 to 14 days after the quit date, support measured 14 days after the quit date for the time period of 15 to 30 day and support measured 30 days after the quit date predicted lapses for 31 to 90 days after the quite date. However, the baseline perceived social support (measured prior to the quit date) did not predict lapses for any time period, which is in line with the current study, in which baseline received social support did not predict smoking cessation.

Results regarding the third hypothesis found some interacting effects of social support with self-regulatory factors. Received social support interacted with volitional self-efficacy and with coping planning regarding smoking cessation but not with action planning. Only few prior studies took self-regulatory and social factors into account in health behaviour change. Scholz,
Ochnser, Hornung and colleagues (2013) applied the HAPA-model and demonstrated main effects of received social support over and above the self-regulatory factors in the context of nutrition behaviour, but did not test interactions between social support and self-regulatory factors. So far to my knowledge no other studies have integrated social support in the HAPA-model. This is surprising because in the HAPA-model, barriers and resources are taken into account with social support as a specific resource (see Figure 1).

Regarding the fourth hypothesis, the results demonstrated that the interactions between received social support and volitional self-efficacy, respectively coping planning indicated a synergistic effect. The combination of high levels of received social support and high levels of volitional self-efficacy or coping planning were beneficial with regard to successful smoking cessation. As there are only a few prior studies on the combination of self-regulatory and social factors, comparing these results to the current state of research is rather difficult. A study by Warner and colleagues (2011) tested the interaction of self-efficacy and social support with regard to perceived autonomy in multi-morbid individuals and found interfering effects. However, the sample and behavioural outcome of the current study was completely different.

Overall, paper 2 demonstrated an interplay of self-regulatory factors and received social support in smoking cessation, which was assessed as self-report and additionally biochemically verified. So far models of individual self-regulation in health behaviour change and the role of social support have mostly been examined separately. The current results indicate that joint influences of self-regulatory and social factors might even be more important than bare main effects.

8.1.3 Direct study – joint effects of different social factors in smoking cessation

In this section, the results of paper 3 are discussed. The analysed data was collected in the direct study. The main purpose was to examine unique and joint effects of different social factors
in the context of smoking cessation, namely social support and social control. This was analysed in a sample of smokers who cohabited with their non-smoking partner. Social support and control were assessed as received from this partner.

The first and second hypotheses tested whether social support and social control, both received from the partner, had unique effects on smoking cessation. Moreover, as a third hypothesis, it was examined whether joint effects of received social support and control emerged. It was tested if received social support moderated the relationship between social control and smoking cessation. Finally as fourth hypothesis it was explored if the interaction between these different social factors indicated a synergistic effect (meaning that a combination of high levels of social control with high levels of social support would be most beneficial regarding smoking cessation).

Results on the first and second hypotheses showed neither main effects of received social support nor of social control with regard to smoking cessation. The lack of a main effect of received social support was not unexpected, as this was also the case in paper 2 and was discussed there (see chapter 8.1.2). Regarding main effects of social control on smoking behaviour and on health behaviour in general, prior studies showed mixed findings (e.g., Lewis & Rook, 1999). In some studies social control was related to smoking fewer cigarettes (Rook et al., 1990; Umberson, 1992), whereas in other studies social control from the spouse was related to increasing health-compromising behaviours such as smoking (Helgeson et al., 2004). A study from Westmaas and colleagues (2002) may shed light on these mixed findings. In this study, effects of social control on smoking were tested and gender differences were taken into account. It was demonstrated that for men, increased social control was related to greater reduction in smoking two days and also four months after the smoking cessation quit date. For women, social
control was associated to smaller reduction in smoking. Hence, receiving social control seems to be more beneficial for men than for women regarding smoking behaviour.

The current study applied another perspective to explore the mixed effects of social control on smoking: it was tested if the effects of social control on smoking depend on the levels of social support (hypotheses three and four). Results confirmed an interaction between received social control and support. For individuals who reported receiving lower levels of support from their partner it was beneficial to also receive lower levels of social control with regard to smoking cessation. For a minority of participants who reported receiving very high levels of support from their partner, high levels of social control were beneficial. Hence for the majority of the participants, no synergistic effect of received social support and control was found. It rather seems that social support works like a basis for the combination with social control: at low levels of received social support, social control is not constructive, and high levels of control are only beneficial when combined with the rare cases that report very high levels of social support. This is in line with studies that find mostly positive effects of social support in health behaviour change (Yarchesi, Mahon, Yarcheski, & Canella, 2004) and with mixed findings regarding social control (Lewis & Rook, 1999). Social control seems to lead to better health behaviour but is also related to arousing psychological distress (Lewis & Rook, 1999). Very high levels of social support were probably able to buffer the negative consequences of social control while also benefitting from the positive consequences.

Two prior studies explored the interplay between social support and social control. Fekete and colleagues (2006) found in their study on older adults who were recovering from knee surgery no main effect from spousal social support or control on adherence or knee pain. The interaction between social support and positive social control from the partner showed that support was less beneficial for adherence when patients also reported high levels of spousal
control (Fekete et al., 2006). However, it should be noted that social support was assessed as problematic support and that social support, control, and adherence were measured at the same time point. This is in contrast to the current study that applied a longitudinal design. A study by Khan and colleagues (2013) applied a diary design to explore the effects of spousal support and control in older adults with Type 2 diabetes. Spousal support moderated the relationship between spousal control and energy expenditure the next day: an increase of spousal control was associated with an increase in energy expenditure when spouses also provided high levels of social support whereas spousal control was not associated with change in energy expenditure the following day when social support was low (Khan et al., 2013).

A further explanation for the mixed findings regarding the main effects of social control and the interactive effects of control and support may lie in the different operationalisation of social control. In the current study social control was assessed as the control that is received from the partner as positive strategies, such as making suggestions. Other studies reported positive and negative social control or social control received from different persons. A study by Tucker and Anders (2001) demonstrated that experiencing negative social control was associated to engaging in health-compromising behaviours, while experiencing positive social control was related to attempts to conduct the desired behaviour. The associations between receiving social control and the behaviour could mostly be accounted for by the receiver’s affective response (Tucker & Anders, 2001). Thus further studies should assess positive and negative control strategies separately to disentangle the mixed effects.

Overall, paper 3 demonstrated that social support and social control interact with regard to smoking cessation, which was assessed objectively. So far only a few prior studies examined joint effects of social support and social control in health behaviour change. The third paper
provided first evidence that the effectiveness of social control in smoking cessation depends on levels of social support.

8.2 Discussion of methodological aspects

In this section, methodological aspects will be discussed regarding the research design, sample and measures. Within the paragraph research design, a discussion of the applied health behaviours smoking and nutrition behaviour will be included. The applied theoretical background model, the HAPA-model, will be discussed in a separate paragraph.

8.2.1 Discussion of the studies’ research design

In this section, first the research designs of the nutrition study and of the direct study will be discussed separately. Afterwards the chosen health behaviours nutrition and smoking will be described.

In the nutrition study, from which the data for paper 1 originated, a longitudinal design with three follow-ups was applied. The main purpose of the nutrition study was to test the effects of different planning interventions on nutrition behaviour and social-cognitive variables. It was therefore conducted as a randomised controlled trial. In contrast, the main purpose of paper 1 was to test the effects of phase-specific self-efficacies on nutrition behaviour. Moreover, it was analysed if intentions worked as phase allocators, i.e. moderated the association between volitional self-efficacy and nutrition behaviour. In paper 1, only data from the baseline assessment and the six months follow-up was taken into account and it was controlled for the intervention factors. Regarding the aims of paper 1, a study design with a baseline assessment and a follow-up after six months without any intervention would have been adequate. Nevertheless, collecting data for paper 1 in a larger project as the nutrition study had a major advantage of having a large number of participants (N = 373) from the general public. Moreover,
the more complex design should not be a disadvantage as it was controlled for intervention effects. The chosen health behaviour, nutrition behaviour, is also adequate for testing phase-specific self-efficacies. It is a behaviour that applies to everybody and is performed every day. The increasing percentage of overweight individuals demonstrates that many people struggle to eat healthily. This high number of affected individuals made it easy to reach a high number of participants from the general population. In addition, prior studies testing phase-specific self-efficacies in the context of nutrition behaviour did not test effects of self-efficacy over time as done in *paper 1*. Hence, *paper 1* was the first study testing effects of phase-specific self-efficacies across time in the context of nutrition behaviour.

Data analysed in *paper 2* and *paper 3* were collected in the direct study. The direct study was a larger project funded by the Swiss National Science Foundation. The purposes were manifold, including examining various research questions, e.g. which dyadic processes are related to successful smoking cessation of a smoker; which processes are related to mood and relationship satisfaction of the smokers and also their non-smoking partners; whether these processes differ for men and women; whether these processes differ for short-term and longer-term effects. To answer these questions a complex design was required. After baseline assessment participants also returned to the university lab for two follow-ups (approximately 29 days and six months after the self-set smoking cessation date). Moreover, they filled out diary questionnaires on smartphones for 32 days around the self-set smoking cessation date. Besides the smoking participants, the sample also included their non-smoking partners. This complex study design demanded a lot of time and effort of the participating couples. Thus only motivated couples participated. This high commitment can be seen in the low dropout rate. Hence *paper 2* and *paper 3* profited from this design.
Though, complex study designs have disadvantages, too. The complex design might have served like an intervention, although no intervention was conducted in the study. The targeted behaviour, i.e. smoking, was assessed at baseline and at the follow-ups by self-report and objectively. Additionally, in the diary questionnaires self-report of smoking was asked daily for 32 days. Assessing the behaviour this often may cause intervention effects itself (e.g., Poston & Hanson, 2010). This assumption is affirmed by the number of smoking participants who were smoke-free at the follow-up after approximately one month (32.1% were continuously abstinent from their quite date until the follow-up and were all biochemically verified as abstinent at the follow-up). In contrast to other studies reporting cessation of self-quitters (abstinence rates of about 20% after one months, e.g., Garvey, Bliss, Hitchcock, Heinold, & Rosner, 1992; Hughes et al., 1992), this percentage was rather high.

To sum up, as only data from the baseline assessment and the follow-up after approximately one month was analysed in paper 2 and paper 3, a less complex design would have been adequate. However, regarding the manifold research questions which were addressed in the direct study, this complex design was necessary.

Examining smoking as a particular health behaviour seems appropriate for the purposes of papers 2 and paper 3. It is a behaviour performed by at least every fourth adult in the Swiss population (Keller et al., 2011) and is thus quite common. Regarding social control, the most-controlled target behaviour is reducing smoking or quitting (Lewis & Rook, 1999), which makes it very likely for smokers to receive social control regarding their smoking behaviour.

To investigate the main purpose of this thesis, which is examining self-regulatory and social factors that are relevant in health behaviour change and exploring combinations of these factors, two exemplary health behaviours were examined for the three papers: nutrition behaviour and smoking. These particular behaviours were chosen for several reasons. First of all, smoking
and unhealthy eating, which likely leads to overweight or obesity, are dangerous for one’s health. Overweight and smoking are related to higher morbidity and mortality (e.g., Guh et al., 2009; U.S. Department of Health and Human Services, 2004) and are the leading causes of preventable death (Mokdad et al., 2004, 2005). Secondly, smoking and overweight are common around the world and are reaching epidemic proportions. In Switzerland 27% of the adult population smokes (Keller et al., 2011), 30% do not care at all about their nutrition and 37% are overweight or obese (Eichholzer et al., 2010). Thirdly, to escape the negative consequences of smoking and an unhealthy nutrition, it is necessary to change this behaviour, such as to quit smoking and to change nutrition to a balanced diet and maintain it throughout one’s life. Finally, smoking and nutrition behaviour are different kinds of health behaviours: a healthy nutrition can be seen as health-enhancing behaviour, whereas smoking and an unhealthy nutrition belong to health-compromising or risk behaviours. To avoid the health risks of smoking, smoking cessation is the only solution, whereas with nutrition behaviour, eating cannot be stopped but the actual nutrition behaviour needs to be changed. Healthy eating as a health-enhancing behaviour is a behaviour that needs to be performed by everybody every day. Although in many countries rates of people who eat unhealthily and/or who are overweight or obese are increasing (e.g., Caballero, 2007), so far in most countries no legal regulations are known. Also, some studies claim today’s environment to be toxic regarding our food and exercise habits (e.g., Wadden et al., 2002). In contrast, smoking is seen as a risk behaviour that seems to decrease in high income countries. In many countries, smoking is regulated by law: it has been prohibited in public buildings, taxes have been raised on tobacco products, there have been informative campaigns about the dangers of smoking (including warning labels on cigarette packages), and helplines have been installed to support smokers who want to quit (WHO, 2011).
8.2.2 Discussion of the studies’ samples

The sample of paper 1 originated from the nutrition study. Overall 373 overweight or obese participants were recruited from the general population. At the follow-up after six months, 274 (73.5%) participants took part. Analyses indicated that the dropouts could not be treated as random subsample of the study sample (as the missing pattern was missing at random, MAR) and hence could not be deleted completely. Therefore, multiple imputation was used to account for missing data (see Graham, 2009). The sample seemed appropriate regarding the purposes of paper 1 (testing the effects of phase-specific self-efficacies in the process of nutrition behaviour change). All participants had a body weight that was too high and the average BMI of the participants was 31.05, indicating obesity. This is in contrast to the samples of the majority of prior studies examining phase-specific self-efficacies in the context of nutrition behaviour, as participants’ overweight was mostly not a necessary condition (e.g., Renner et al., 2008; Schwarzer & Renner, 2000; Schwarzer et al., 2007). Bearing in mind the negative consequences of obesity (see chapter 2.2.1), it was reasonable for the participants in the nutrition study to change their nutrition behaviour and to lose weight.

The sample of paper 2 and paper 3 originated from the direct study. The sample consisted of 106 smoking participants and their non-smoking partners from the general public. Inclusion criteria for the participants were very strict. Both partners needed to have sufficient knowledge of the German language to be able to answer questionnaires by themselves. They needed to have been in their relationship for at least a year and cohabiting for at least six months. These criteria were established to make sure to include only heterosexual couples in a committed relationship or married couples. In prior studies examining the interplay of social support and social control or effects of social control on smoking (e.g., Fekete et al. 2006; Helgeson et al., 2004; Homish & Leonhard, 2005; Umberson, 1992), the samples often consisted of married couples only. These
days in Switzerland, couples do not necessarily have to be married to be in a committed relationship, and it was assumed that cohabiting was sufficient for this criterion. Only heterosexual couples were included because it could not be ruled out, that there were differences between homosexual and heterosexual couples in the social processes regarding smoking cessation (for differences between heterosexual and homosexual couples see e.g., Kurdek, 2004). An exclusion criterion was working in shift work. This was due to the diary phase in which participants answered daily questionnaires in the evening before going to bed. As participants did not work in shift, controlling for bedtime was easier. Moreover, pregnancy was an exclusion criterion because it is assumed that the process of smoking cessation for a pregnant smoker or for a smoking husband of a pregnant non-smoking wife might be different compared to non-pregnant couples (for harmful effects of smoking during pregnancy and for children see chapter 2.1.2). Further criteria for the smoking partner was smoking at least one cigarette a day because only daily smokers would be included in the sample (see definition of smokers by the WHO, 1998). They smoked on average 16.59 cigarettes daily at baseline, which is slightly more compared to the daily smoking Swiss adult population (on average 14.2 cigarettes, Keller et al., 2011). An inclusion criteria of the non-smoking partner was that he/she had never smoked or had quit smoking at least five years ago. This time span was chosen according to the termination phase of the transtheoretical model (Prochaska & DiClemente, 1983).

Besides these strict inclusion and exclusion criteria, the study design was complex and required a lot of time and effort of the participants (see chapter 4.2). This made it difficult to recruit enough participating couples. However, couples who initially attended baseline assessment showed a high commitment. Only eight couples dropped out before the first follow-up. However, including 106 smoking participants and their non-smoking partners, the sample was rather small. In paper 2 and paper 3 only smokers’ data was analysed. Samples with about 100
participants have limited power to detect interaction effects (e.g., McClelland & Judd, 1993). Hence a larger sample would have been more convenient. Besides the relatively small numbers of participants, the sample seemed appropriate regarding the purposes of paper 2 and paper 3. Both papers explored the role of social support from the partner. It can be seen as a further limitation that the couples’ relationship quality was not controlled for. Nevertheless, according to the inclusion criteria it was at least insured that smoking participants cohabited with a non-smoking partner and this source of support was available. Bearing in mind the strict inclusion criteria, generalisability of the results might be limited, for example regarding same-sex couples or couples with both partners smoking.

8.2.3 Discussion of the studies’ measures

All constructs which were examined in the three papers in this thesis were measured with well-established scales. If necessary, items of these scales were adapted to the context of nutrition behaviour or smoking behaviour. Self-regulatory constructs from the HAPA-model (Schwarzer, 1992, 2008) were mostly assessed by scales from a study by Scholz and colleagues (2009), which examined smoking and nutrition behaviour. For measuring received social support, a scale by Burkert and colleagues (2005), which was developed for the context of smoking, was used and for measuring social control items by Butterfield and Lewis (2002) were used. Most of the scales revealed a satisfying internal consistency (Cronbach’s alpha values $\alpha > .70$, e.g., Cortina, 1993) when applied in the nutrition or direct study. Detailed information on the measures is given in the papers (see chapters 5, 6, 7), so in this chapter only two salient aspects are discussed: the measures of the outcome variables and the measures of the social processes.

In paper 1 the outcome was nutrition behaviour which was assessed as self-reported low-fat dietary intake. It was measured with a food frequency questionnaire which analysed the frequency of the intake of low-fat food during the previous four weeks (Renner et al., 1996). The
items concerned consumption of the following low-fat food: low-fat meat, low-fat sausage, low-fat fish, poultry, low-fat cheese, semi-bold cheese, low-fat milk or dairy products. This scale was one of the few in this thesis with low internal consistency (\( \alpha < .70 \)). Considering the different kinds of low-fat food which was assessed, this is not surprising. Participants may, for example, often eat low-fat meat but not eat any (low-fat) fish at all. Even participants with high scores on this scale (indicating that they ate a lot of low-fat products) might still have consumed many high-fat food products as well (e.g., cake and chocolate), because the consumption of high-fat products was not assessed. Therefore some participants with high scores on the low-fat scale may overall still not have followed a low-fat diet. In general self-report measures question the validity of the assessment. Participants were asked about their food intake during the previous four weeks, which might be too long a time to recall accurately. Alternative food intake may be measured objectively, e.g. with direct observation or videotaping but this would cause an enormous effort to assess over a longer time span (i.e. individuals needed to be observed 24 hours per day to make sure not to miss any eaten food). Moreover, objective assessments of food intake may cause reactive changes in the nutrition behaviour, whereas the applied self-report measure was completed in retrospect (Wolper et al., 1995).

In the direct study the outcome variable, smoking behaviour, was measured in different ways. Numbers of daily smoked cigarettes and continuous abstinence were assessed as self-reported. Moreover, smoking was measured objectively with a carbon monoxide test as a biochemical verification (West et al., 2005). Of these different measures of smoking, continuous abstinence is the most rigorous and conservative one. The combination of assessing smoking at a follow-up as self-reported continuous abstinence and verifying the self-report with an objective measure at the same follow-up (as it was done in paper 2) is often considered a gold standard (e.g., Hughes, Keely, Niaura et al. 2003; West et al., 2005). In general self-report of smoking
might bias the validity of the assessment. Considering the results of *paper 2*, objective measures of smoking are not beyond doubt either. The Smokerlyzer was used as carbon monoxide test of expired air. As proposed by other studies (e.g., West et al. 2005), cut-off point was set at 9 parts per million (\(\leq 9\) p.p.m indicate successful quitters, \(>9\) indicate smokers). This resulted in 63.2% successful quitters and non-smokers at the follow-up (T2) whereas according to the self-reported continuous prevalence 32.1% were non-smokers. It should be noted that continuous abstinence means no smoking (or including one little lapse of smoking one puff up to maximal 5 cigarettes) since the quit date, whereas the objective measure only assessed the smoking status at a specific point in time. Carbon monoxide tests detect smoking during the last 24 hours approximately. Thus it might be expected, that the less strict measure of objective point prevalence resulted in more successful quitters than the self-reported continuous abstinence. Considering the large difference between these two measures (self-reported continuous abstinence 32.1%, objective point prevalence 63.2% abstainers) and the fact, that all participants who reported abstinence were also verified by the objective test, it might be assumed that the self-reported measure seemed to be more accurate than the objective test, which seemed to be to less sensitive in detecting smokers.

In the direct study the assessment of social processes was included. In *paper 2*, received social support was analysed and in *paper 3* received social support and social control were analysed. Comparing social support and social control, social support aims at supporting someone in translating his/her own intentions into action and is mostly applied reactively to support someone in a difficult situation. In contrast, social control strategies are used proactive when inducing a specific behaviour from another individual. These different functions of social support and social control allow individuals to provide and to receive these two social processes simultaneously. Usually, they are positively related (e.g., Franks et al., 2006; Khan et al., 2013).
In *paper 2* and *paper 3* social support and control from the non-smoking partner were assessed, while other sources of support or control were neglected. Support or control from the partner was chosen due to the fact that married individuals usually report their spouse as their most important source of social support and social control (e.g., Schwarzer & Gutierrez-Dona, 2005; Umberson, 1992). Besides different sources, social processes can also be analysed from different perspectives. In *paper 2* and *paper 3* only the perspective of the smoking partner who reported the support or control received from his/her non-smoking partner was taken into account. Further aspects would be the perceived support from the non-smoking partner (for differentiation between perceived and received support see chapter 2.3.1), the provided support reported from the non-smoking partner or the seeking of social support. When taking different perspectives of support into account further studies may explore how sought support from one partner is provided by the other partner and how this support transaction is finally received.

Although provided and received social support assess the same support from two different perspectives, these perspectives of support receiver and provider do often not closely correspond (Dunkel-Schetter, Blasband, Feinstein, & Bennett, 1992). The discrepancies between the reports of received and provided support are also considered in the theory of invisible support (e.g., Bolger, Zuckerman, & Kessler, 2000). In this approach it is assumed that being aware of actual received support can lead to emotional costs whereas support which is provided from a partner but not noticed by the receiver (i.e. invisible support) is the most beneficial (e.g., Bolger & Amarel, 2007; Bolger et al., 2000). In this thesis only received support was included; therefore invisible support transaction in the participating couples could not be detected.

Regarding the interactions between self-regulatory factors and social support or the interactions between social support and social control, it would be interesting to include the perspective of seeking social support. It might, for example, be that smokers with low individual
resources were seeking support. Smokers with low individual resources cannot count on their own strengths to master difficult and stressful undertakings as quit smoking. Thus it is likely, that they will seek for support from a significant other, which might enhance the chance of abstinence as well as buffer distress (see stress-buffering effect, Cohen & Wills, 1985).

### 8.2.4 Discussion of the health action process approach as theoretical framework of self-regulatory factors

In the nutrition study and in the direct study the HAPA-model (Schwarzer, 1992, 2008) was applied as the theoretical background model to investigate self-regulatory factors in health behaviour change. In contrast to other models of behaviour change which specify intentions as the most important predictor of behaviour (e.g., the theory of planned behaviour, Ajzen, 1991; the protection motivation theory, Rogers, 1975), the HAPA-model also focuses on the process of translating intentions into action. This is especially important in the samples integrated in this thesis, as although individuals in the nutrition study as well as in the direct study were highly motivated to change their nutrition behaviour (averaged intention of 5.37 on a scale ranging from 1-6, see chapter 5) and to quit smoking (averaged intention of 5.53 on a scale ranging from 1-6, see chapter 6) respectively at baseline, not all participants were successful in changing their behaviour. This indicates that further factors need to be taken into account in the process from intentions to actions (e.g., Sheeran, 2002). In the HAPA-model these are volitional self-efficacy, action planning, coping planning and action control.

Regarding the nutrition study and the purposes of study 1 (testing phase-specific self-efficacies), assumptions of the HAPA-model were tested. Phase-specific self-efficacies are supposed to work only in the corresponding phase, which can be tested within the framework of this model, which also assumes different phases in health behaviour change. Prior studies in the context of nutrition behaviour change successfully applied the HAPA-model (e.g., Renner et al.,...
In general the HAPA-model has been applied to several different health behaviours, settings and samples, and its universality, applicability, and predictive validity have been demonstrated (Schwarzer, 2008).

Regarding the direct study examining smoking as the target behaviour, the HAPA-model is less popular. So far prior studies could not demonstrate the assumed factors in the volitional phase, volitional self-efficacy, action planning and coping planning as predictors of smoking behaviour (Scholz et al., 2009) or assessed only the number of daily smoked cigarettes as outcome (Radtke et al., 2012; Schwarzer & Luszczynska, 2008). No study has so far examined the stricter measure of smoking abstinence (as continuous abstinence or objective point prevalence) within the framework of the HAPA-model. This was done in paper 2 but results also failed to demonstrate main effects of these variables on smoking cessation.

A model that was developed specifically for the context of smoking behaviour and which is often applied in the context of smoking cessation is the transtheoretical model (TTM, Prochaska & DiClemente, 1983). Like the HAPA-model, the TTM-model is also classified as stage theory of health behaviour (in contrast to continuum theories, see chapter 2.4). It assumes that individuals undergo six different phases in a certain time span in the process of behaviour change. As the name of this theory indicates, factors of different theories were integrated, such as self-efficacy or decisional balance (c.f. self-efficacy and outcome expectancies in the social-cognitive theory by Bandura, 1977, 2001). The TTM-model is quite popular but has also been criticised, mostly because of the arbitrary time spans which are assumed in the process of behaviour change (e.g., Sutton, 2001). Further assumptions of the TTM-model are the processes of change (Prochaska & DiClemente, 1983), which make the TTM-model interesting regarding the main purpose of paper 2 (examining the interplay of self-regulatory factors and social support) as one of these ten processes is helping relationships. Helping relationships is defined as
having helpful relationships to significant others who support the smoking cessation (e.g. having someone to talk about the smoking when needed) and is thus similar to the construct of perceived social support. *Helping relationships* have been shown to be beneficial in the action and maintenance phase of the smoking cessation process (Perz, DiClemente, & Carbonari, 1996). Andersen (2006) tested how smokers who had an indigenous helper in the process of smoking cessation compared to smokers without a helper differed in their smoking behaviour. Results failed to demonstrate *helping relationships* as a predictor of point prevalence or forward stage movement according to the stages of the TTM (Andersen, 2006). Compared to paper 2, the study by Andersen (2006) did not explore interacting effects of social influences and self-regulatory variables. Studies by Povey and colleagues (2000) or Warner and colleagues (2011) did so but tested within different theoretical models (theory of planned behaviour) and with different behaviours (healthy eating, autonomy in multi-morbid adults). Hence, it remains unclear how the demonstrated interacting effect of self-regulatory factors and social support in the context of smoking cessation (see paper 2, chapter 6) would unfold within another theoretical framework and when testing other self-regulatory variables. Future studies should thus further explore these relationships by applying different theoretical backgrounds and testing different models against each other.

### 8.3 Limitations and strengths

In this chapter the limitations of the nutrition study and the direct study will first be discussed. Afterwards, the strengths of these studies will be described.

#### 8.3.1 Limitations

Most of the limiting facts were discussed in chapter 8.2 and will only be shortly mentioned here. Regarding paper 1 the major limitation is the self-reported measure of nutrition
behaviour. A food frequency questionnaire assessed the frequency of intake of different low-fat products (see chapter 8.2.3). Other assessment methods might have given a more valid picture of the nutrition behaviour.

The direct study is limited in the generalisability regarding the very specific sample of smoking / non-smoking couples (see chapter 8.2.2). Social processes may play a different role in couples with both partners smoking. A further limitation of paper 2 and paper 3 is the fact that only the perspective of the smoking partner was taken into account. Social support and social control were reported by the smoker who received it from the non-smoking partner (see chapter 8.2.3). Furthermore, the time span between quit date and follow-up was on average 29 days, so longer-term results were not included. In smoking cessation most relapses happen in the first eight days after the quit attempt. This time span was covered with this follow-up. Nevertheless it would be interesting to follow smokers over a longer time period, as relapse rates are even higher then. Studies which report the smoking status of individuals 12 months after quitting usually find less than five percent successful abstainers, for example (Hughes, Keely, & Naud, 2003).

In this thesis, self-regulatory factors (of the framework of the HAPA-model) and social factors are taken into account for the maintenance or change of health behaviours. It might be seen as a limitation that other factors were not considered. One of these factors is cognitive dissonance (Festinger, 1957), which might also play an important role in behaviour maintenance or change. The theory of cognitive dissonance proposes that different cognitions of an individual can be relevant or irrelevant to each other. Cognitions which are related can be consonant or dissonant. Dissonant cognitions are perceived as disturbing and motivate individuals to reduce their cognitive dissonance (Festinger, 1957). In the context of health behaviour change, strategies to reduce cognitive dissonance may be lowering the perceived health risk of an unhealthy behaviour, for example.
Hornung (1986) applied the theory of cognitive dissonance in the context of smoking behaviour. In smokers the two cognitions “I smoke” and “smoking is harmful to one’s health” are dissonant. To resolve this problem, smoking cessation would be a definitive solution. However, as described in this thesis, smoking cessation is a very difficult and stressful endeavour and more than half of the smoking adults in Switzerland do not want to quit (see chapter 2.1.2). Hence individuals who continue smoking need to apply other strategies to reduce their cognitive dissonance (see Hornung, 1986). One strategy is to deny the harmful effects of smoking on health. As most smokers in Western countries are currently informed about these effects (see chapter 2.1.1), it might be more likely that smokers do not completely deny these effects. Instead, smokers estimate their own risk for harmful health effects as smaller than for smokers in general (e.g., McMaster & Lee, 1991). Another strategy to reduce cognitive dissonance is to accept the long-term risk of smoking but to concentrate more on the short-term benefits of smoking. A comparison of smokers and non-smokers demonstrated that smokers named more positive attributes of smoking than non-smokers (van Harreveld, van der Pligt, & de Vries, 1999). Smokers emphasised short-term benefits of smoking such as “smoking helps to relax, increases the ability to concentrate, fosters social interaction, helps to conceal one’s uneasiness, reduces nervousness, prevents getting too heavy” whereas non-smokers stressed longer-term health consequences of smoking such as “smoking increases the likelihood of lung cancer and heart disease”. The importance of such attitudes towards the behaviour is taken into account in, for example, the theory of planned behaviour (Ajzen, 1991) where attitudes are suggested as predictors of intentions.

Besides the described strategies to reduce cognitive dissonance, another strategy would be to compensate for the harmful health effects of smoking. Individuals are assumed to look for the best balance between maximising pleasure and minimising harm and one strategy to reach this
balance is the activation of compensatory health beliefs (CHBs, Rabiau, Knäuper, & Miquelon, 2006). These are defined as beliefs that a negative effect of an unhealthy behaviour can be neutralized or compensated by performing another behaviour which is healthy, e.g. the harmful effects of smoking can be compensated by doing physical exercise. There is first evidence that compensatory health beliefs are negatively related to the readiness and intention to quit smoking in adolescents (Radtke et al., 2012; Radtke, Scholz, Keller, Knäuper, & Hornung, 2011). Thus compensatory health beliefs seem to be another relevant factor in the maintenance of smoking behaviour, and it can be therefore seen as limitation that this was not taken into account in this thesis.

Studies assessing motives of smoking demonstrate that smokers do not smoke simply because of cravings, but that several different motives might be involved, including hedonistic ones like mentioned above. Shiffman (1993) gathered the following motives: smoking in response to craving, smoking without awareness, smoking when upset, smoking for pleasure, smoking for motor or sensory aspects, smoking for stimulation, smoking in company, smoking to boost social image or confidence, solitary smoking, and smoking to suppress appetite. This list shows that smoking is caused by motives of physical dependence but also by individual and social factors (as described in chapter 2.2.1). The applied theoretical framework in this thesis, the HAPA-model, only takes some individual factors into account to explain behaviour change. Social factors are additionally integrated in this thesis but factors corresponding to emotions are neglected. In the HAPA-model outcome expectancies are considered as predictors of intention but with the assumption that individuals weigh up advantages and disadvantages of the behaviour unemotionally and in a rational manner. Moreover, emotions are not included in the volitional phase of behaviour change although the list of motives (Shiffman, 1993) demonstrated that in many situations emotions are involved. Many smokers use smoking to reduce negative affect or
use it as reward. Smoking to reduce negative affect, e.g., to calm down or reduce anger, can also be used as coping strategy by the smoker. In the HAPA-model and in this thesis, such emotions are not taken into account. This might be seen as major limitation.

These considerations also apply to nutrition behaviour. Besides hunger and physiological need, Renner, Sprösser, Strohbach and Schupp (2012) demonstrated several other motives of nutrition behaviour. Many included social or emotional situations, such as rewarding oneself, eating as distraction or eating because of feelings of loneliness. Freund and Hennecke (2012) demonstrated another individual factor to be relevant in nutrition behaviour change. They examined the goal focus of overweight women participating in a weight-loss programme. Focusing on the process of behaviour change (following the diet) was associated with success in daily dieting and weight loss, and negatively related to deviations from the diet whereas focusing on the outcome of behaviour change (weight loss) was related to more disinhibition after lapses. Overall, women focusing on the process showed more successful goal pursuit and achievement compared to women focusing on the outcome (Freund & Hennecke, 2012). Thus models trying to explain nutrition behaviour or its change should consider such factors, too. The fact that the mentioned different motives and corresponding emotional factors, as well as individuals factors as goal orientation, were not included in this thesis is a major limitation.

8.3.2 Strengths

Data analysed in the three papers of this thesis was collected in larger research projects. A strength of the nutrition study and thus paper I is the sample. The sample was large and consisted of adults from the German speaking Swiss general public. Moreover all participants were overweight or obese. Considering the harmful effects of overweight and obesity, it was reasonable for the participants to change their nutrition behaviour. At the follow-up after six months, 26.5% of the participants had dropped out. The missing pattern was missing at random
(MAR), indicating that the probability of missing values depended on the observed values. Hence dropouts could not be completely deleted, as they could not be seen as a random subsample of the study sample at baseline. To account for the missing data, the multiple imputation method (MI) was applied (Graham, 2009; Schafer & Graham, 2002). In this Monte Carlo technique missing values are replaced by a list of several stimulated values in generating multiple datasets. For the analyses in paper 1, five such datasets were generated. Each dataset was analysed separately and results were then combined in order to obtain overall estimates and standard errors. Multiple imputation method reflects the missing data uncertainty by the between-imputation variance, which is an advantage compared to single imputation methods. Moreover, multiple imputation method is often seen as state of the art (Graham, 2009; Schafer & Graham, 2002). Thus, applying this technique is an asset of paper 1.

The data analysed in paper 2 and paper 3 was assessed in the direct study. The sample consisted of adult smokers from the German speaking Swiss general public. According to the inclusion and exclusion criteria, it was a strictly selected sample but it can still be seen as a strength that participants were recruited from the general public. Moreover, the dropout rate was very small. A further strength of the direct study was the assessment of the smoking behaviour (see chapter 8.2.3). Smoking was assessed with different self-report items and additionally was also measured objectively. This enabled analyses regarding point prevalence and continuous abstinence across time. Combinations of measuring smoking as self-reported continuous abstinence and objectively at the same follow-up can be considered as the gold standard in assessing smoking behaviour (e.g., Hughes, Keely, Niaura et al., 2003; West et al., 2005).

The nutrition and the direct study were both larger research projects and both applied a longitudinal design. The complex study designs can be considered major strengths because they allow for further perspectives regarding statistical analyses beyond the analyses enclosed in the
three papers integrated in this thesis. The diary phase included in the direct project especially offers several approaches, e.g., it enables studying intraindividual changes during the process of smoking cessation. By assessing self-regulatory and social factors on a daily basis, possible changes in these factors or in the behavioural outcomes can be tracked in smaller steps. Moreover, including the perspective of the partner as well will result in a more fine-grained picture of the effects of self-regulation and of close relationships on health behaviour change in daily life (see e.g., Stadler et al., 2012).

In this thesis a theory-based approach was applied to explore processes in health behaviour change. The HAPA-model (Schwarzer, 1992, 2008) was chosen as the theoretical framework regarding self-regulatory factors. In paper 1, the role of phase-specific self-efficacies within the HAPA-model was explored in the context of nutrition behaviour. One of the strengths of the first paper was that, to the best of my knowledge, it was the first paper demonstrating the unique predictive validity of motivational self-efficacy in predicting intentions across time. Furthermore, it was also the first to demonstrate the moderating role of intentions on the association between volitional self-efficacy and behaviour, and it thus confirmed intentions as phase allocator. To sum up, paper 1 showed that phase-specific self-efficacies play an important role in nutrition behaviour change and that they unfold their relevance uniquely in the corresponding phase of the process of behaviour change.

In paper 2, the HAPA-model was applied as the theoretical framework regarding self-regulatory factors, too. Besides these factors, social support and the combination of self-regulatory factors with social support were included in the analyses. Exploring models of self-regulatory resources in the health behaviour change, such as the HAPA-model, and exploring the role of social support so far have been two separate lines of research. Only a few prior studies have examined the effects of self-regulatory factors and social factors in health behaviour
change. Combinations and joint effects of these factors are even rarer. It can therefore be considered a major strength of this thesis that the combinations of self-regulatory factors and social support were examined in smoking cessation. To the best of my knowledge, paper 2 was the first to demonstrate these joint effects in smoking cessation. Moreover, results indicated synergistic effects of self-regulatory and social factors and showed that joint effects might be more important than mere main effects.

Paper 3 focused on another research area which has so far been understudied: the combination of social support and social control. This is surprising since most married individuals report receiving social support and control from their spouse. It was a strength of the third paper that it was, to the best of my knowledge, the first to demonstrate that the effectiveness of social control in the process of smoking cessation depended on the levels of social support.

Social support was included as received social support in this thesis, which can be considered a further strength. Received social support is less studied than perceived support (e.g., Böhmer et al., 2007), although received social support assesses concrete support transactions whereas perceived support refers to stable perceptions of support available if needed (Sarason et al., 1986; Schwarzer & Knoll, 2010). As the results of paper 2 and paper 3 showed, received social support is a crucial factor in smoking cessation. It might not have direct main effects on the smoking behaviour, but it takes a moderating role. Looking at the association between self-regulatory factors and smoking, results indicated that both self-regulatory and social resources are necessary in a synergistic manner for successful smoking cessation. Regarding the association between social control and smoking, a different picture emerged. For individuals reporting low levels of received social support, the combination with low levels of social control was beneficial regarding their smoking cessation. Only for individuals with very high levels of received social support, high levels of social control were beneficial. Prior studies explored social support as
buffering negative effects of stressful situations and thus postulated social support as moderator on the association between stress and health (Cohen & Wills, 1985). It can be considered as a major strength of this thesis that it shed further light on the moderating role of social support between different predictors and health behaviour change.

8.4 Implications for future research and recommendations for practice

In this chapter, implications which derived from the nutrition study and the direct study will be discussed. Afterwards, practical recommendations of these studies will be described. This chapter will be kept short, as more detailed implications are discussed in the corresponding papers in chapters 5, 6 and 7.

8.4.1 Implications for future research

*Paper 1* of this thesis demonstrated the unique role of phase-specific self-efficacies in nutrition behaviour change. Moreover, phase-specific self-efficacies unfold their relevance only in the corresponding phase. Thus, future research should take motivational and volitional self-efficacy into account in the process of behaviour change.

*Paper 2* and *paper 3* demonstrated the important moderating role of social support in smoking cessation. Only a few prior studies have examined the joint effects of social support and self-regulatory factors (e.g., Povey et al., 2000; Warner et al., 2011) or of social support and social control (e.g., Fekete, 2006; Khan et al., 2013) in the context of health behaviour. It remains unclear how social support interacts with self-regulatory factors or with social support in other contexts of health behaviour change or when testing with different samples. In general, results showed that it is especially important to combine the two lines of research of self-regulatory and social factors. It is surprising that few studies have combined these factors, as health behaviours such as smoking or eating are very often conducted in company. Hence it can be assumed that
social factors might have at least some influence. Future studies should therefore further explore
the moderating role of social support within different contexts and samples.

In this thesis social support was assessed as received support reported by the smoker. When taking the non-smoking partner’s perspective into account as well, support provided by the non-smoking partner and the same support received by the smoker could be conferred. As stated in an earlier chapter, these two perspectives of the same support transaction do not always correspond (Dunkel-Schetter et al., 1992). Further, it would be interesting to assess the mobilisation of support in order to answer research questions about who is seeking social support, if support is then provided, if this support is also received by the partner and so on. Future studies should thus include many different perspectives of social support.

With regard to the behavioural outcome, this thesis showed that self-report and objective measurements both have advantages and disadvantages. Hence, whenever possible, behavioural outcomes should be assessed with different measures of self-report and objective measures.

8.4.2 Recommendations for practice

Results from paper 1 supported the differentiation between motivational and volitional self-efficacy. Hence, providing different interventions to individuals in different phases of behaviour change is recommended. For individuals in the motivational phase, interventions that aim at strengthening their belief of being able to start a new behaviour would be most beneficial. Those individuals who have already made concrete decisions to change their behaviour, or have even engaged in the new behaviour, profit more from the confidence in their abilities to actually master the challenges of behaviour change. According to Bandura (1977), self-efficacy results from four different sources, and ideally interventions should boost these sources. The first source, mastery experience, refers to personal mastery experiences. Successful conductions of behaviour raise mastery expectations, whereas repeated failures lower them. The second source of self-
efficacy is *vicarious experience*. When observing another individual performing a particular behaviour successfully, one’s own self-efficacy will improve. Via social comparison the other individual is seen as a model and the conclusion is drawn that if the other succeeds, one can do so as well. In the third source of self-efficacy, *symbolic experience*, self-efficacy is enhanced by verbal persuasion. Individuals are led to believe that they can master particular situations or behaviours through suggestions and affirmation of others. A less important source of self-efficacy is *emotional arousal*. High arousal usually complicates behaviour performance. Thus individuals will more likely expect to succeed when they do not have to bother with aversive arousal (Bandura, 1977). As this description of the different sources of self-efficacy indicates, two sources include at least one other individual. Thus, when creating interventions to enhance self-efficacy, the social environment should be taken into account as well. This suggestion corresponds to the results of *paper 2*, which demonstrated the equal relevance of individual and social resources in health behaviour change. Interventions regarding health behaviour change should include individual resources and the social environment. This might be seen as the major practical recommendation of this thesis. Regarding *paper 3*, results confirmed the importance of social support as moderating factor in health behaviour change. As social control seemed to be only beneficial for individuals who receive high levels of social support and is rather harmful for individuals who receive low levels of social support, interventions should aim at boosting social support, not at social control.

### 8.5 General conclusions

The main purpose of this thesis was to examine the role of self-regulatory and social factors in health behaviour change. Moreover, the combined effects of these factors have been explored.
With regard to *paper 1*, the following conclusions can be drawn: A) The phase-specific distinction of self-efficacy was supported. It showed sufficient discriminant validity. B) Motivational self-efficacy was a unique predictor of behavioural intentions across time. C) Volitional self-efficacy could not predict behaviour across time. However, the association between volitional self-efficacy and behaviour was moderated by intentions. Only individuals in the volitional phase benefited from volitional self-efficacy in terms of behavioural change.

With regard to *paper 2* and *paper 3*, the results have shown the following: A) The combined synergistic effects of social support and individual resources demonstrated that both individual resources and social support were relevant in health behaviour change. B) The joint effects of social support and social control indicated that for individuals reporting low levels of social support, receiving social control was not beneficial. Only for few individuals reporting high levels of social support, receiving social control was beneficial. C) Social support played a crucial role in health behaviour change. It might not have had main effects on behaviour but in its moderating function it determined the effects of other factors on behaviour change.

As a general conclusion it can be stated that this thesis further investigated the role of different self-regulatory and social factors in health behaviour change. The major strength was the combination of different research areas, which have mostly been examined separately so far: self-regulatory factors and social factors. The major finding explored the moderating role of social support. Future studies should continue to examine this moderating role and to explore joint effects of social and self-regulatory factors as well as of different social factors. Profound knowledge of the effectiveness of these factors should improve interventions, which should help individuals break bad habits and maintain healthy lifestyles.
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Paper 1: Testing Phase-specific Self-efficacy Beliefs in the Context of Dietary Behaviour Change

By Sibylle Ochsner, Urte Scholz, & Rainer Hornung

A similar version of this chapter is published:

Abstract

**Background:** Self-efficacy is an important predictor of health-behaviour change. Within the health action process approach (HAPA) a motivational and a volitional self-efficacy can be distinguished. Motivational self-efficacy is assumed to serve as predictor of intention formation whereas volitional self-efficacy should unfold its relevance for the behaviour change. This study examined these assumptions in a sample with overweight and obese individuals. Moreover, it is tested whether behavioural intentions moderate the association between volitional self-efficacy and behaviour.

**Methods:** Overall, 373 overweight and obese individuals completed a baseline and six months later a follow-up questionnaire on HAPA-variables and dietary behaviour.

**Results:** A factor analysis confirmed the phase-specific separation of self-efficacy. Motivational self-efficacy emerged as predictor for behavioural intentions over and above other HAPA-variables after six months whereas volitional self-efficacy did not. Volitional self-efficacy interacted with intention in the prediction of behaviour indicating that volitional self-efficacy is only beneficial for individuals with high levels of intentions.

**Conclusions:** The results provide evidence for the phase-specific distinction of self-efficacy in the context of dietary change in an overweight or obese sample. Thus, differentiating between motivational and volitional self-efficacy beliefs should be considered when developing future interventions of dietary change.

**Keywords:** health-behaviour change, phase-specific self-efficacy, health action process approach, diet, overweight
Introduction

Food habits have changed over the last decades, resulting in the consumption of more fatty and sugared food, which leads to a higher risk for several diseases (WHO, 2000). However, many people fail to change their nutrition behaviour on a long-term basis (Kumanyika et al., 2000). This study focuses on the processes and factors involved in successful long-term modifications of people’s diets in general and on reducing daily fat intake in particular. Reducing caloric intake by following a low-fat diet leads to better satiety, palatability and more weight loss comparing to following other diets (Astrup et al., 2000; Shah et al., 1994) and is recommended to maintain lifelong to keep a healthy weight (Shick et al., 1998).

Self-efficacy beliefs and nutrition

Self-efficacy is known as an important predictor of health behaviour change (Schwarzer, 2008). It originates from Bandura’s social-cognitive theory and is defined as the self-confidence in one’s own capability to initiate and maintain a new behaviour even if obstacles emerge (Bandura, 1997). Research on self-efficacy includes the investigation on health behaviours such as dietary behaviour, physical exercise or breast self-examination. In these behaviours, high self-efficacy has been shown to ease the adoption and maintenance of the behaviour (Schwarzer, 2008).

In the context of nutrition behaviour, self-efficacy has proven to be an important factor and is examined in many studies (e.g., Contento et al., 2002). Research demonstrated that individuals with higher nutrition self-efficacy are more likely to act upon their intentions and translate plans into action (Gutierrez-Dona, Lippke, Renner, Kwon, & Schwarzer, 2009; Richert et al., 2010). Self-efficacy seems to be a core factor for the initiation and maintenance of dietary behaviour (Richert et al., 2010) and people with a higher nutrition-specific self-efficacy are more
successful in changing their nutrition in comparison to people with a lower nutrition-specific self-efficacy (Schwarzer, 2008).

**Phase-specific self-efficacy beliefs**

Among theories of health behaviour change, the health action process approach (HAPA; Schwarzer, 2008) places a special emphasis on self-efficacy beliefs. The HAPA-model distinguishes between a motivational and a volitional phase. In the motivational phase, risk awareness, outcome expectancies and self-efficacy are predictors of intention. After the intention formation the volitional phase follows, in which intention, action control, planning, and self-efficacy are specified as predictors of behaviour. Self-efficacy has been shown to be beneficial in both phases, namely in the formation of intentions, the initiation and maintenance of behaviour, and the recovery after a lapse (Schwarzer, 2008).

According to the HAPA-model, self-efficacy can be distinguished into a motivational self-efficacy, which works as one of the predictors of intention formation in the motivational phase and a volition self-efficacy which works as predictor of behaviour in the volitional phase (Schwarzer & Luszczynska, 2008). This concept of phase-specific self-efficacies has been brought up in the domain of addictive behaviours (Marlatt et al., 1995). The distinction was developed due to the assumptions that people have to succeed in different tasks during behaviour change, and different phase-specific self-efficacies support these tasks.

Motivational and volitional self-efficacies have been recently investigated but are defined and named differently by various authors. In the current study the terms motivational and volitional self-efficacy are used according to the phases of the HAPA-model. The motivational self-efficacy refers to the overall confidence to perform a behaviour. In this first phase the individual has not acted yet, but is about to form an intention to do so. High motivational self-
efficacy is associated with the development of intention to change a behaviour (e.g. Luszczynska & Schwarzer, 2003; Renner, Spivak, Kwon, & Schwarzer, 2007; Scholz et al., 2005; Schwarzer et al., 2007). The volitional self-efficacy refers to beliefs about one’s capability to maintain a behaviour over longer time and even if obstacles emerge. Therefore it is assumed to be relevant when intentions are high and hence indicative of the volitional phase (e.g. Luszczynska & Schwarzer, 2003; Renner et al., 2007; Scholz et al., 2005).

In the domain of nutrition behaviour there are only a few studies concerning phase-specific self-efficacies (Renner et al., 2008; Schwarzer & Luszczynska, 2008; Schwarzer & Renner, 2000; Schwarzer et al., 2007). They assessed different behavioural outcomes such as low-fat diet, high-fat food consumption, fruit and vegetable consumption or diet rich in vitamins, but they had major similarities: All studies were based on the HAPA-model as theoretical background and assessed factors of the motivational phase (risk awareness, outcome expectancies, motivational self-efficacy, behavioural intentions) at baseline and factors of the volitional phase (volitional self-efficacy, planning, behaviour) four weeks to six months later. These studies found evidence for the effectiveness of the motivational and volitional self-efficacy in the domain of nutrition behaviour: Motivational self-efficacy was associated with intentions whereas volitional self-efficacy was associated with nutrition behaviour. However, these associations were assessed cross-sectionally testing association between motivational self-efficacy and behavioural intentions as well as volitional self-efficacy and behaviour at the same point of measurement (Renner et al., 2008; Schwarzer & Luszczynska, 2008; Schwarzer & Renner, 2000; Schwarzer et al., 2007). Thus, it remains unclear whether or not these associations hold across a temporal sequence that is when the two phase-specific self-efficacy beliefs are assessed at an earlier point in time and the outcomes at a later point in time.
Moreover, none of the four studies concerning nutrition behaviour tested the predictive power of the different phase-specific self-efficacies in competition to each other and therefore no conclusions can yet be drawn about the unique predictive power of the phase-specific self-efficacy beliefs. It is assumed that the phase-specific self-efficacies unfold their relevance in the corresponding phase and are rather ineffective in other phases in the process of behaviour change. This assumption can be tested by moderator analyses with phase indicators as moderator variables, which was done in studies concerning physical exercise (Scholz et al., 2005) and pelvic-floor exercise after prostatectomy (Burkert, Knoll, Scholz, Roigas, & Gralla, 2012).

Scholz and colleagues (2005) demonstrated that the association between volitional self-efficacy (in this case called maintenance self-efficacy) and behaviour was moderated by past behaviour as indicator of being in the maintenance phase of a behaviour change. Individuals who had already started the behaviour before and were therefore maintaining the behaviour, benefited more from the volitional self-efficacy than those who had not started before (Scholz et al., 2005). Moreover, having a relapse in conducting a new behaviour moderated the association between recovery self-efficacy (meaning the belief about one’s capability to return to an intended behaviour after a lapse) and behaviour. For individuals, who experienced a relapse, recovery self-efficacy was beneficial, but it had no effect for individuals who conducted the behaviour without relapse (Burkert et al., 2012; Scholz et al., 2005). The terms maintenance or recovery self-efficacy are used to specify in more detail which of these two facets of volitional self-efficacy is salient in the process of behaviour change. Maintenance self-efficacy refers to the maintenance of a behaviour over longer time whereas recovery self-efficacy is beneficial after a lapse or relapse.

While some studies (e.g., Scholz et al., 2005) and models (e.g., the transtheoretical model; Prochaska & Velicer, 1997) use past behaviour as phase indicator, other approaches use intention
as phase indicator (c.f. the HAPA-model; Schwarzer, 2008; the model of action phases by Heckhausen, 1977). Past behaviour and behavioural intentions differ in their functions: while past behaviour is used to indicate the allocation to the maintenance phase in behaviour change (e.g., Scholz et al., 2005), intentions are used to differentiate between the allocation to the motivational or volitional phase. The latter approach was applied in the present study in which behavioural intentions are tested as moderator on the association between volitional self-efficacy and behaviour.

High behavioural intentions are allocating to the volitional phase in which volitional self-efficacy is expected to be related to behaviour, whereas low behavioural intentions refer to the motivational phase, in which volitional self-efficacy is expected to be ineffective. Testing behavioural intentions as moderator has not been done so far and will enhance our knowledge about the combination of volitional self-efficacy and behavioural intentions in the process of behaviour change.

**Aims of current study**

The current study ties up on the described studies concerning nutrition behaviour. To the best of our knowledge, no previous study tested the roles of phase-specific self-efficacy beliefs in predicting behavioural intentions and behaviour at a later time in the domain of nutrition behaviour with overweight or obese individuals. Moreover, it is explored whether the association between phase-specific self-efficacies and phase-specific outcomes are moderated by a phase indicator (i.e., behavioural intention). Our assumptions are:

1. Motivational self-efficacy is a stronger predictor of behavioural intentions six months later than volitional self-efficacy controlled for the effects of the HAPA-variables risk perception and outcome expectancies.
2. Volitional self-efficacy is a stronger predictor of low-fat dietary intake six months later compared to motivational self-efficacy controlled for the effects of the HAPA-variables action planning, action control and behavioural intentions.

3. Behavioural intentions moderate the association between volitional self-efficacy and low-fat dietary intake six months later.

**Method**

**Sample and Procedure**

Data for this longitudinal study were collected within a randomized controlled trial which aimed at changing dietary intake in overweight and obese individuals (Scholz, Ochsner, & Luszczynska, 2013). The sample was recruited via newspaper advertisements and web pages. Inclusion criteria were: Being 18 years or older, overweight or obese (Body mass index, BMI, > 25), with sufficient knowledge of the German language and no participation in a professional weight-loss program at the same time.

Participants were randomly allocated to the control group or one of four intervention groups. The baseline assessment (T1) took place at the laboratory of the Department of Psychology at the University of Zurich. Participants received information about the study and the procedure, and signed an informed consent form. Next, participants were given an information sheet about a healthy and low-fat diet based on the guidelines of the Swiss Society of Nutrition and completed a questionnaire.

Participants of the control group completed the baseline assessment as described above but did not receive any further treatment. Respondents assigned to one of the four interventions groups additionally took part in different planning interventions: a single planning group, and three groups with 3, 6, or 9 weeks’ repeated planning interventions (for a detailed description of
the different planning interventions as well as the results of the RCT please see Scholz, Ochsner, and Luszczynska, 2013).

Six months after baseline, the follow-up questionnaire (T2) was sent to the participants of all groups by mail together with a prepaid return envelope. Participants who completed the study received 50 CHF. All participants were treated in accordance to the ethical guidelines of the Helsinki Declaration 2000.

The sample consisted of 373 participants, including control and all intervention groups. Of these 373 participants, 72.4% (n = 270) were women and the mean age was $M = 52.42$ ($SD = 12.79$) with a range from 18 to 82 years. The majority of the participants were married or in a committed relationship (n = 247, 66.2%), 15.5% (n = 58) were divorced, 13.7% (n = 58) were single, 4.3% (n = 16) were widowed and one person (0.3%) did not report his/her marital status. The majority of participants (n = 261, 70%) had children. Most participants were currently employed (n = 226, 60.6%) and had attended 9 years of schooling (n = 231, 61.9%). The average BMI was $M = 31.05$ ($SD = 4.41$).

Of the initial 373 participants, 274 (73.5%) completed the questionnaire six months later. No significant differences emerged between dropouts and participants who completed both questionnaires with regard to motivational self-efficacy, volitional self-efficacy, behavioural intentions, low-fat dietary intake, outcome expectancies, action planning and action control. Among socio-demographic and control variables no significant differences emerged for sex, having children, education, social desirability and being in the control or in one of the intervention groups.

However, systematic dropout emerged for risk awareness ($F(1, 369) = 10.49, p = .001$) which was higher in dropouts ($M = 4.48, SD = 1.28$) than in continuers ($M = 4.00, SD = 1.26$). In
terms of socio-demographic variables, significant differences emerged for age ($M = 48.57$, $SD = 13.58$ for dropouts, $M = 53.82$, $SD = 12.23$ for continuers, $F(1, 371) = 12.64$, $p = .000$) and BMI ($M = 32.13$, $SD = 5.18$ for dropouts, $M = 30.67$, $SD = 4.04$ for continuers, $F(1, 368) = 8.15$, $p = .005$). Divorced participants and housewives were more likely to dropout whereas married and retired participants were more likely to continue ($\chi^2 (3) = 8.29$, $p = .040$ for marital status, $\chi^2 (4) = 10.84$, $p = .028$ for employment).

**Measures**

Measures of all constructs and socio-demographic variables were assessed at time 1. At time 2, behavioural intentions and low-fat dietary intake were assessed. Unless otherwise stated, the response format was a six-point Likert scale ranging from 1 = completely disagree to 6 = completely agree. Means, standard deviations and Cronbach’s Alphas are reported in Table 2. The following item examples are translated from German.

*Motivational self-efficacy* was assessed by three items which were adapted from Scholz and colleagues (2005), for example “I am confident that I can change my dietary habits.” (see Table 3).

*Volitional self-efficacy* was measured with four items adapted from Scholz and colleagues (2005), for example “I am confident that I can maintain a low-fat diet on a long-term basis even if I cannot see any positive changes immediately.” (see Table 3).

*Behavioural intentions* were assessed by six items adapted from Scholz and colleagues (2009), for example „I intend to eat a low-fat diet (e.g. low-fat meat, low-fat cheese, etc.).“
Table 2.

**Means, standard deviations, internal consistency and correlations of main study variables and potential control variables (N = 373)**

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>range</th>
<th>α</th>
<th>Intent T2</th>
<th>Intent T1</th>
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<th>Vol SE</th>
<th>Risk</th>
<th>Outex</th>
<th>AP</th>
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<td>.32***</td>
<td>.19**</td>
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<td>.15**</td>
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<td>.43***</td>
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<tr>
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<td>-.20***</td>
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<td>.14**</td>
<td>.01</td>
<td></td>
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<td>AP</td>
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<td>1.31</td>
<td>1-6</td>
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<td></td>
<td>.41***</td>
<td>-.10#</td>
<td>.12*</td>
<td>.07</td>
<td>.13*</td>
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<td>.08</td>
<td>.05</td>
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<td>2.60</td>
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<td></td>
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<tr>
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<td></td>
<td></td>
<td>-.12*</td>
<td></td>
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</tr>
</tbody>
</table>

**Note.** Intake: low-fat dietary intake; Intent: behavioural intention, Mot SE: motivational self-efficacy, Vol SE: volitional self-efficacy, Risk: risk awareness, Outex: outcome expectancies, AP: action planning, AC: action control, SD: social desirability; Sex: 1 = men, 2 = women, # p < .10, * p < .05, ** p < .01, *** p < .001. Pooled correlations from 5 imputed data sets. Means (M), standard deviations (SD), range and internal consistency (α) based on original unimputed data.
Low-fat dietary intake was measured with a food frequency questionnaire assessing the frequency of intake of low-fat food during the past four weeks (adapted from Renner, Hahn, & Schwarzer, 1996). After the item stem “During the past four weeks how often did you eat…” 7 items regarding low-fat food, as example “low-fat milk or low-fat dairy products?” followed. The response format ranged from 0 = never to 6 = several times a day.

Risk awareness was measured by four items (Scholz et al., 2009), for example “If I keep my lifestyle the way it is, there is a high likelihood that I will develop severe health problems.“

Outcome expectancies consists of five items adapted from Scholz et al. (2009), for example „If I eat a low-fat diet, then I can lose weight.“

Action Planning was measured by four items (Scholz et al., 2009), for example “I have made a detailed plan regarding when (at what meal) to change my eating habits”.

Action Control was assessed by nine items (Scholz et al., 2009). The items were introduced by the stem “During the past four weeks…” and followed by items as “I closely monitored my eating behaviour.”, “I had my intentions to change my eating habits often on my mind.”, or “I tried my best to act in accordance to my intentions.”

Social desirability was assessed as a control variable. 16 items from the social desirability scale (SDS-17) were used (Stöber & Luther, 2001). The response format was dichotomous with 1 = do not agree versus 2 = agree, higher values indicating higher social desirability.

Dummy variables of the intervention groups were composed as participants were part of a randomized controlled trial (further details on the intervention study are described in Scholz, Ochsner, and Luszczynska, 2013) to control for the intervention factors.
Table 3.

*Pattern matrix of the factor structure of phase-specific self-efficacy beliefs using principal component analysis with varimax rotation.*

<table>
<thead>
<tr>
<th>Items</th>
<th>Factor 1</th>
<th>Factor 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am confident that I can change my dietary habits.</td>
<td>.27</td>
<td>.82</td>
</tr>
<tr>
<td>I am confident that I can eat healthily most of the time.</td>
<td>.07</td>
<td>.84</td>
</tr>
<tr>
<td>I am confident that I can manage to keep a balanced diet.</td>
<td>.25</td>
<td>.85</td>
</tr>
<tr>
<td>I am confident that I can maintain a low-fat diet on a long-term basis even if I cannot see any positive changes immediately.</td>
<td>.69</td>
<td>.39</td>
</tr>
<tr>
<td>I am confident that I can maintain a low-fat diet on a long-term basis even if I am together with friends and relatives who do not keep a low-fat diet.</td>
<td>.77</td>
<td>.23</td>
</tr>
<tr>
<td>I am confident that I can maintain a low-fat diet on a long-term basis even if I feel like eating something else.</td>
<td>.82</td>
<td>.09</td>
</tr>
<tr>
<td>I am confident that I can maintain a low-fat diet on a long-term basis even if I do not feel well.</td>
<td>.79</td>
<td>.12</td>
</tr>
</tbody>
</table>

*Note.* Primary factor loadings are shown in bold. Factor 1 = volitional self-efficacy, factor 2 = motivational self-efficacy. Based on original unimputed data.

**Data analyses**

Dropout analyses have shown that the missing pattern was missing at random (MAR) meaning that the probability of missing values depends on the observed values. Therefore, the dropouts could not be treated as a random subsample of the study sample and could not be completely deleted. Instead, Multiple Imputation method (MI) was used to account for missing data (Graham, 2009). Multiple Imputation is a Monte Carlo technique that replaces each missing value by a list of several simulated values in form of generating multiple datasets. Each data set is analyzed separately and results are combined to obtain overall estimates and standard errors.
Compared to single imputation methods, Multiple Imputation has the advantage of reflecting the missing-data uncertainty (Graham, 2009). For the present study, five data bases were generated and analyzed. Univariate and multivariate outliers were treated according to Tabachnick and Fidell (2001). All analyses were conducted with SPSS 20. Principal component analyses with varimax rotation were computed to test whether the phase-specific distinction of self-efficacy was of sufficient discriminant validity. Extraction criterion was Eigenvalue > 1 (Tabachnik & Fidell, 2001). Main analyses were multiple regression analyses to test the unique predictive validity of phase-specific self-efficacy beliefs as competing predictors and a hierarchical regression analysis was performed to test for moderation. For the prediction of behavioural intentions and low-fat dietary intake at T2, the control variables (social desirability, age, sex, dummy variables of the intervention groups), phase-specific self-efficacy beliefs and phase-specific social-cognitive variables as specified in the HAPA-model at T1 served as predictors. In the moderation model, control variables were entered first. In a second step behavioural intentions, action planning, action control, self-efficacy beliefs and the respective moderator were entered followed by the interaction terms in the final step. To avoid problems with multicollinearity, the variables that built the interaction term were mean-centered (Cohen, Cohen, West, & Aiken, 2003). Simple slope analyses were run to display and test the interaction effects (Preacher, Curran, & Bauer, 2006).

**Results**

**Descriptive statistics**

To test the factorial validity of the phase-specific self-efficacy beliefs, a principal component analysis with varimax rotation was conducted (see Table 3). All items of the motivational and volitional self-efficacy at T1 were entered. The analysis resulted in a two factor
solution: Volitional self-efficacy consisted as expected of four items with an Eigenvalue of 3.52 and accounted for 50.33% of total variance, motivational self-efficacy consisted as expected of three items with an Eigenvalue of 1.31 and accounted for 18.74% of variance. Thus, principal component analysis confirmed the distinction of the phase-specific self-efficacy beliefs.

Correlations of the motivational and volitional self-efficacy, the HAPA-variables, low-fat dietary intake and potential control variables are displayed in Table 2. Motivational and volitional self-efficacy were moderately correlated. All HAPA-variables were correlated in a positive association with behavioural intention at T1 and T2, except of risk awareness, which was not correlated significantly with behavioural intentions at T2. Outcome expectancies, action planning and behavioural intentions at T1 were also positively correlated with low-fat dietary intake at T2. From the potential control variables, BMI was the only one not significantly correlated with the outcomes behavioural intentions and low-fat dietary intake and therefore BMI was not included in the analyses, whereas social desirability, sex, age and the dummy variables were included as control variables. The correlations from sex and age showed that women reported higher behavioural intentions at T1 and T2 as well as higher action planning, and that increasing age was related to higher reports of intention at T1 and T2, motivational and volitional self-efficacy and outcome expectancies.

**Prediction of behavioural intentions at T2**

For the prediction of behavioural intentions at T2 a multiple regression analysis was conducted including control variables, phase-specific self-efficacy beliefs, risk awareness and outcome expectancies as predictors. As shown in Table 4, motivational self-efficacy strongly predicted behavioural intentions whereas volitional self-efficacy did not emerge as a predictor. Outcome expectancies also predicted behavioural intentions as expected according to the HAPA-
model but risk awareness did not. In terms of the control variables, one of the dummy variables to control for the intervention and sex showed an effect, indicating that participants of the nine-weeks planning intervention group as well as women reported higher behavioural intentions.

**Prediction of low-fat dietary intake at T2**

Control variables, phase-specific self-efficacy beliefs and the HAPA-variables action planning, action control and behavioural intentions were entered in a multiple regression model to predict low-fat dietary intake at T2 (see Table 4). As expected, motivational self-efficacy did not emerge as predictor, but volitional self-efficacy also did not predict low-fat dietary intake. In line with the assumptions of the HAPA-model, behavioural intentions at T1 and action planning emerged as predictors but unexpectedly action control did not. In terms of the control variables, sex was the only significant predictor showing that men reported higher low-fat dietary intake than women.

**Phase indicators as potential moderators**

To test whether behavioural intentions at T1 as an indicator of being in the motivational or volitional phase moderated the relationship between volitional self-efficacy at T1 and low-fat dietary intake at T2, a hierarchical regression analysis was conducted (see Table 5). In a first step, control variables were entered, followed by phase-specific self-efficacies, the moderator behavioural intentions, risk awareness and outcome expectancies in a second step, and finally in a third step the interaction terms. In the last step, action planning, sex, and one of the dummy variables emerged as predictors, indicating that men and participants in the single planning intervention group reported higher low-fat dietary intake. Volitional self-efficacy was not able to explain variance in low-fat dietary intake at T2 but behavioural intentions emerged as predictor.
Table 4.

Prediction of behavioural intentions at T2 and low-fat dietary intake at T2

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Behavioural intentions T2</th>
<th>Low-fat dietary intake T2</th>
</tr>
</thead>
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<tr>
<td></td>
<td>b</td>
<td>SE b</td>
</tr>
<tr>
<td>Social Desirability</td>
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<td>.02</td>
</tr>
<tr>
<td>Age</td>
<td>.01</td>
<td>.00</td>
</tr>
<tr>
<td>Sex</td>
<td>.18#</td>
<td>.10</td>
</tr>
<tr>
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<tr>
<td>Dummy variable 2</td>
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<td>Action control</td>
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<td>Intention at T1</td>
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</table>

*R² total*  
.17 - .22  
.08

*Note. Sex: 1 = men, 2 = women; # p < .10, * p < .05, ** p < .01, *** p < .001. Findings are based on 5 imputed data sets. Due to multiple imputation unstandardized coefficients and ranges of $R^2$ are reported. Prediction of behavioural intentions at T2: $F(11, 361) = 6.53 – 9.41***$. Prediction of low-fat dietary intake at T2: $F(12, 261) = 1.80 – 1.83*$.
Table 5.  

*Moderation analysis on volitional self-efficacy at T1 by level of behavioural intentions at T1 predicting low-fat dietary intake six month later (T2).*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Step 1</th>
<th></th>
<th>Step 2</th>
<th></th>
<th>Step 3</th>
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<tr>
<td>Vol SE*intent</td>
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<tr>
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<td>.04*</td>
<td></td>
<td>.03**</td>
<td></td>
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</table>

*Note. SD: social desirability, mot SE: motivational self-efficacy, vol SE: volitional self-efficacy, intent T1: behavioural intentions at T1, AP: action planning, AC: action control, Sex: 1 = men, 2 = women; # p < .10, * p < .05, ** p < .01, *** p < .001. Findings are based on 5 imputed data sets. Due to multiple imputation unstandardized coefficients are reported. Prediction of low-fat dietary intake at T2: Step 1: F(7, 266) = 1.45, Step 2: F(5, 261) = .23-2.31*, Step 3: F(2, 259) = 4.93-5.05**.*
Moreover, the interaction between volitional self-efficacy and behavioural intentions was significant whereas the interaction between motivational self-efficacy and behavioural intention was not. As displayed in Figure 4, for individuals with low behavioural intentions at T1 which indicates being in the motivational phase, only a low positive association between volitional self-efficacy and behaviour emerged. However, for individuals with high behavioural intentions at T1 which indicates being in the volitional phase, the low-fat dietary intake at T2 was rather strongly positively associated with the volitional self-efficacy at T1: The higher the volitional self-efficacy reported, the higher the low-fat dietary intake. Simple slope analysis confirmed that the association between volitional self-efficacy and low-fat dietary intake was significant for individuals with higher behavioural intentions (t = 3.01, p = .003) and with a smaller effect also for individuals with lower behavioural intentions (t = 2.09, p = .038).

*Figure 4.* Interaction of volitional self-efficacy and behavioural intentions on low-fat dietary intake at T2.
Discussion

The current study tested the distinction of phase-specific self-efficacies and their relative importance in dietary intention formation and behaviour. Moreover, it was explored whether a phase indicator moderated the association between phase-specific self-efficacies and phase-specific outcomes.

In line with the assumptions of the HAPA-model and with prior findings (Burkert et al., 2012; Scholz et al., 2005), principal component analysis confirmed the distinction of the phase-specific self-efficacy beliefs. In predicting behavioural intentions, motivational self-efficacy emerged as strong predictor whereas volitional self-efficacy was not significantly associated with intentions. Since prior studies (e.g. on physical exercise, Renner et al., 2007; Schwarzer et al., 2007, breast-self examination, Luszczynska & Schwarzer, 2003, or dental flossing, Schwarzer et al., 2007) assessed motivational self-efficacy and intentions at the same time or could not demonstrate a significant association across time (Burkert et al., 2012), the current study is the first that demonstrated the unique predictive validity of motivational self-efficacy to predict behavioural intentions at a later time. As expected, outcome expectancies were also significantly associated with behavioural intentions but risk awareness was not. This is in line with studies on dental flossing, seat belt use (Schwarzer et al., 2007) or smoking in young adults (Schwarzer & Luszczynska, 2008). Likewise, in a study on nutrition behaviour, risk awareness was the weakest predictor of behavioural intentions compared to self-efficacy and outcome expectancies (Schwarzer & Renner, 2000). As risk awareness is assumed to be the starting point of a deliberative process, it might well be that in a sample with rather strong motivation to change a behaviour as was the case in the present study, risk awareness loses its influence. Moreover, the scale-correspondence between risk perception and behavioural intentions was low according to
the principles of compatibility (Ajzen, 1988), as risk perception referred to a healthy lifestyle in general whereas behavioural intentions referred to low-fat dietary intake as a particular health behaviour. Higher correspondence might have resulted in higher associations.

In predicting low-fat dietary intake six months later, behavioural intentions and action planning emerged as significant predictors as in line with the assumptions of the HAPA-model but unexpectedly action control did not. Action plans are formed before the situation happens whereas action control is needed during the behaviour. For the current study’s participants, the prospective strategy seemed to be more successful than the concurrent self-regulation. In a difficult nutrition situation, such as eating in a restaurant, it might be easier to plan ahead which menu to choose than evaluate the menu and eventually stop eating once it is on the plate. The importance of forming action plans and memorizing them in critical situations seems to be crucial especially in complex and repetitive behaviours, as nutrition behaviour (e.g. Wiedemann, Lippke, Reuter, Ziegelmann, & Schüz, 2011, Wiedemann, Lippke, & Schwarzer, 2012).

Contrary to our assumptions volitional self-efficacy did not predict low-fat dietary intake six months later. Prior studies demonstrated an association between volitional self-efficacy and behaviour assessed at the same time (e.g. Luszczynska & Schwarzer, 2003; Renner et al., 2007), and a study concerning physical activity confirmed volitional self-efficacy as unique predictor of behaviour four months later (Scholz et al., 2005). Although no main effect from volitional self-efficacy on dietary intake was found in the present study, behavioural intentions emerged as moderator of the volitional self-efficacy-behaviour relationship. Moreover, in line with our assumptions, the interaction between motivational self-efficacy and behavioural intentions was not significant in predicting behaviour. These findings support the assumptions, that the volitional self-efficacy is beneficial for individuals in the volitional phase only, whereas it is not
effective as a main effect in the whole sample including individuals in the motivational phase. The fact, that the simple slope analysis was significant for individuals with higher behavioural intentions and at a lower level also for individuals with lower behavioural intentions might be seen as a limitation. However, the present study is the first to demonstrate behavioural intentions as moderator – and thus as phase indicator – on the association between volitional self-efficacy and behaviour. In line with prior studies on the moderating effects of phase-indicators for the relationship of phase-specific self-efficacies and phase-specific outcomes (Burkert et al., 2012; Scholz et al., 2005), these findings confirm that phase-specific self-efficacies unfold their unique relevance only in the corresponding phase.

It remains a theoretical question, which of the two interacting variables (volitional self-efficacy and behavioural intentions) is seen as the moderator. Applying a social-cognitive theory perspective (Bandura, 1997) might also justify to consider self-efficacy to be the moderator. In the present study, however, behavioural intentions were considered the indicator of belonging to the motivational or volitional phase in the behaviour change process. Thus, intentions were specified as the moderator.

The present study has several limitations. First, dietary behaviour was assessed by self-reports. This might question the validity of the assessment since the reported amount of food may not be recalled accurately over longer periods. However, objective assessment methods of dietary intake have disadvantages too, such as causing reactive changes in the nutrition behaviour whereas food frequency questionnaires do not cause alterations in consumption because they are completed in retrospect. Moreover, food frequency questionnaires are especially suitable for assessing particular food or food groups (Wolper, Heshka, & Heymsfield, 1995), as done in the present study. Also, social desirability was controlled for to account for potential bias. Another
limitation was the systematic drop-out of participants but this was accounted for by multiple imputation (Graham, 2009).

Finally, it can be argued that in the moderator analysis the phase allocator, behavioural intentions, is a continuous measure. Measuring an individual’s position on continuous dimensions, where each dimension should correspond to a different stage, can be considered as inconsistent with the conceptual perspective of discrete stages (Sutton, 2001). Nonetheless such measures have proved to be useful as it was the case in the present study (e.g. de Vet, de Nooijer, de Vries, & Brug, 2007). On average, the participants had relatively high intentions, therefore it might well be possible that in a sample with a broader range of intentions, even stronger associations with intentions might have emerged.

Despite these limitations, the present findings have some implications. The differentiation between motivational and volitional self-efficacy was supported. Also, results demonstrated that individuals, although being in the same setting such as being overweight and wanting to reduce weight, may be in different stages of behaviour change and therefore need different interventions. For individuals in the motivational phase, interventions should strengthen their belief to be able to start a new health behaviour. Individuals who have already decided to act or have started to act need confidence in their abilities to master difficulties of behaviour change.

Future studies should further investigate the role of the phase-specific self-efficacy beliefs. Profound knowledge about phase-specific self-efficacy beliefs in the process of health behaviour change could improve tailored interventions which should boost the self-confidence in one’s own capability to overcome specific obstacles in the process of health behaviour change.
Acknowledgements

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Paper 2: The Interplay of Received Social Support and Self-regulatory Factors in Smoking Cessation

By Sibylle Ochsner, Aleksandra Luszczynska, Gertraud Stadler, Nina Knoll, Rainer Hornung, & Urte Scholz (2014)

A similar version of this chapter is published:

Abstract

Objective: In smoking cessation individual self-regulation and social support have both proven to be useful. However, the roles of self-regulatory processes and social support are mostly examined separately. The present study aims at examining the unique and joint interactive effects of self-regulation as specified in the health action process approach (HAPA) and social support on smoking cessation. The study tested whether social support can compensate for low levels of self-regulation or whether synergistic effects emerge.

Design & Measures: Around a self-set quit date, 99 smokers completed baseline questionnaires on HAPA-variables, smoking-specific received social support and smoking cessation (continuous abstinence and point prevalence), with a follow-up conducted approximately 29 days after the quit date.

Results: Social support moderated the association between volitional self-efficacy and smoking as well as coping planning and smoking but not between action planning and smoking. No compensatory effect of social support for lower levels of individual regulation emerged but the combination of high levels of the individual variables and social support was related to successful smoking cessation, indicating a synergistic effect.

Conclusions: Results confirm the importance of examining both self-regulation and social factors in smoking cessation. This should be considered when developing future interventions for smoking cessation.

Keywords: health behaviour change, smoking cessation, received social support, health action process approach
Introduction

Smoking causes a higher risk for many diseases such as cancer, stroke or cardiovascular disease. Thereby, smoking behaviour is one significant predictor of the leading causes of death (Mokdad et al., 2004, 2005). Smoking is a multifactorial addiction including physical, mental and social factors. Previous research confirmed individual self-regulation and social factors (e.g., social support and social control) to be important in the initiation of quit attempts and staying smoke-free (e.g. Gulliver et al., 1995; Gwaltney et al., 2009; Park et al., 2004). Nonetheless, smoking cessation and general health behaviour change studies rarely look at the unique and joint influences of individual and social factors which was the aim of the current paper.

Health Action Process Approach

The theoretical background model of the present study was the health action process approach (HAPA; Schwarzer, 2008). The HAPA-model distinguishes between a motivational phase and a volitional phase during the process of behaviour change. The motivational phase results in the formation of an intention to change the behaviour, when people have high risk awareness, hold more positive than negative outcome expectancies and have high motivational self-efficacy. To translate intentions into behaviour in the volitional phase, volitional self-efficacy, action planning and coping planning are specified as postintentional predictors of the behaviour. Volitional self-efficacy refers to optimistic beliefs about one’s capability to maintain behaviour change over a longer period of time and deal with obstacles that arise as well as optimistic beliefs about returning to not smoking after a lapse or relapse has occurred (Schwarzer & Luszczynska, 2008). Action planning is defined as forming specific plans about when, where, and how to perform a certain behaviour. Coping planning refers to the imagination of scenarios that hinder one from performing the intended behaviour and to developing plans to cope with
such difficult situations. The HAPA-model has been applied successfully in the context of smoking (e.g., Scholz et al., 2009; Schwarzer & Luszczynska, 2008). Moreover, it has been demonstrated to be of good applicability, universality and predictive validity regarding different health behaviours and different populations (Schwarzer, 2008).

Social Support

Social support is an interactive process between a provider and a receiver, and it refers to the function and quality of social relationships. It can be differentiated into perceived and received social support (e.g., Schwarzer & Knoll, 2010). Perceived social support comprises the anticipated available support from the social network if it is needed. This general expectation of support in the future somewhat resembles a personality disposition related to optimism and is relatively stable (Sarason et al., 1986). Received social support refers to retrospective reports of actual support transactions in the past (Schwarzer & Knoll, 2010). According to the different definitions and measurement perceived and received social support do not necessarily need to have much in common (Sarason et al., 1986). In the context of smoking cessation, studies investigated perceived and received social support (e.g., Gulliver et al., 1995; Carlson et al., 2002). Most studies, however, have focused on perceived social support. The current study examined received social support from the non-smoking partner in line with the fact that the partner is frequently the most important source of social support (Schwarzer & Gutierrez-Dona, 2005).

Combination of Individual and Social Factors

As outlined above, there are only few studies that try to combine individual and social factors in health behaviour change. There is positive evidence for main effects of social support and individual regulation from the information-motivation-behavioral skills model (for an
The Interplay of Received Social Support and Self-regulatory Factors in Smoking Cessation

overview, see Fisher, Fisher, Amico & Harman, 2006). Moreover, a study from Scholz, Ochsner, Hornung and colleagues (2013) demonstrated first evidence for beneficial effects from received social support over and above self-regulation constructs of the HAPA-model. Research within the frameworks of the theory of planned behaviour (Ajzen, 1991), social cognitive theory (Bandura, 2001), and the transtheoretical model of behaviour change (Prochaska & DiClemente, 1983) that examined self-regulation and added social support to predict intentions or behaviour showed mixed results (e.g., Andersen, 2006; Anderson et al., 2007; Hamilton & White, 2008).

Social support has also been examined as a moderator of the link between self-regulation and health behaviours. Povey and colleagues (2000) added perceived social support to the theory of planned behaviour in the context of healthy eating. They found no main effect of perceived social support on intentions but social support was found to act as a moderator of the association between perceived behavioural control and intention and of the association between attitude and intention (Povey et al., 2000). In the latter, perceived social support was positively related to intentions at all levels of attitudes. However, as levels of social support increased attitude became a stronger predictor of intentions, showing that as social support increased the power of attitude to predict intentions increased as well. This interaction effect indicates a synergistic effect of individual regulation and social support. A different picture emerged for the moderating effect of perceived social support on the association between perceived behavioural control and intentions. At high levels of social support, perceived behavioural control did not predict intention, whereas at lower levels of social support perceived behavioural control was a strong positive predictor of intentions. Effects on behaviour were not tested.

Warner and colleagues (2011) found an interaction effect of self-efficacy and received social support on perceived autonomy in multi-morbid individuals. In individuals with lower self-
efficacy, social support was positively related to the perception of autonomy, showing that they compensated their low levels of self-efficacy with received social support. For individuals with higher self-efficacy, higher levels of social support were interfering with autonomy; the combination of high levels of social and individual resources interfered with perceived autonomy in this sample (Warner et al., 2011). It remains unclear, however, whether these findings can be transferred to health behaviour change.

Overall, there is a considerable lack of research with regard to interacting effects of social support and in particular received social support and individual regulation. This is surprising in that people usually do not change their (health) behaviours in isolation but within certain social contexts (e.g., at home, at work). Results from the few studies available suggest two possible outcomes of an interaction between social and individual variables: compensating or synergistic effects. The compensating function of received social support for deficits in individual self-regulation can be hypothesized for the following reasons: a) partners potentially know their smoking spouses’ weaknesses in individual self-regulation best (e.g. Sillars & Scott, 1983); thus, support could compensate for self-regulation deficits. And b) for most smokers, trying to quit smoking is a stressful situation (McMahon & Jason, 1998), that may be even worse for individuals with lower individual resources. In this taxing situation, social support could be buffering and be most helpful for those individuals who need it the most because of their low levels of self-regulation (see also Warner et al., 2011 for compensating function). Alternatively, the synergistic effects of social support and individual regulation variables as for example found by Povey and colleagues (2000) for the association of attitudes and intentions may also appear in the context of smoking cessation. Quitting smoking is a very difficult endeavor with very high rates of relapse (e.g., relapse rates of over 70% after one month, Hughes, Keely, & Naud, 2003).
Thus, self-regulation alone might not suffice but smokers might be in need of both high self-regulation skills and high levels of received social support from their spouses.

**Aim of the Study**

To the best of our knowledge, no studies on the joint effects of received social support and individual regulation with regard to smoking cessation exist so far. Therefore, the aim of the current study was to examine whether smoking-specific received social support and individual self-regulation, in particular volitional self-efficacy, action planning and coping planning interact with regard to smoking cessation. Due to the lack of research on the joint effects of social and individual variables in the context of health behaviour in general compensating or synergistic effects of social support and individual regulation were tested as two alternative hypotheses.

**Method**

**Sample and Procedure**

The sample consisted of 106 smoking participants at T1. Of these, 72.6% (n = 77) were men and the mean age was 40.67 years (SD = 10.03, ranging from 19 to 72). The majority of participants was married (n = 69, 65.1%), 34.9% (n = 37) were not married but according to inclusion criteria, all participants were in a committed relationship and cohabiting with a non-smoking partner of the opposite sex. In large parts, participants had children (n = 62, 58.5%). Most participants were currently employed (n = 86, 81.1%) and reported having attended 9 years of schooling (n = 75, 70.8%). Overall, participants had a strong intention to quit smoking (see Table 6).

The study was part of the larger project “Dyadic and Individual Regulation to End Chronic Tobacco Use (DIRECT)” funded by the Swiss National Science Foundation (100014_124516). The sample was recruited via newspapers, web pages and a marketing
research institution. Inclusion criterion was smoking at least one cigarette per day (in line with the definition of daily smokers by the WHO (1998). In this study, 99% of the participants smoked more than one cigarette daily). Moreover, being in a committed relationship or married to a non-smoking partner for at least one year, cohabiting with the partner for at least six months and wanting to quit smoking were further inclusion criteria. Exclusion criteria were: participation in a professional program on smoking cessation, being pregnant or partner being pregnant, working in shift work and insufficient comprehension of the German language. Non-smoking partners also participated in the DIRECT project, but were not focused on in this study.

Prior to the baseline assessment, participants were emailed a questionnaire (T0) which was completed online. The baseline assessment (T1) then took place at the university laboratory. After receiving information about the study and the procedure, participants signed an informed consent form and received a personal code to ensure anonymity. Then they announced their self-set quit date, which was on average 17 days (range 8 – 39 days) after T1, and completed a questionnaire. Moreover, smoking was biochemically verified with a carbon monoxide test of expired air. On average, 29 days (range 21 – 58 days) after the quit date, respondents returned to the lab for the second assessment (T2). Participants again completed a questionnaire and biochemical verification of smoking status. After finishing T2, they received compensation of 100 Swiss Francs. Six months after the quit date, the last assessment (T3) took place at the lab and respondents received again 100 Swiss Francs. Additionally there was a diary phase with 32 diary days between T1 and T2 around the self-set quit date. In this study, data from baseline and from T2 are focused on, whereas the diary data and 6-month follow-up were not included. The rationale for examining potential joint effects of smoking-specific received social support and individual self-regulation before the quit date and post-quit date smoking cessation in the short-
term rather than a longer-term (six months) perspective lies in the chosen constructs. In contrast to perceived social support, received social support is not assumed to be stable over time, but a measure of retrospective support transactions from the partner. It is thus highly likely that either success or failure in smoking cessation during the six month period will impact social support received from the partner. Likely, the partner will adapt their support provision to the outcome over time. Thus, including received social support before the quit date to predict smoking cessation six months later may not be justified. In contrast, received support and joint effects of received support with volitional constructs are rather likely to display short-term effects on smoking cessation after the quit-date (i.e., as assessed at the 1-month follow-up at T2). The diary data address different research questions and are thus also not focused on in the present study. All participants were treated in accordance to the ethical guidelines of the Helsinki Declaration 2000.

Measures

At Time 0, in the initial questionnaire, socio-demographic variables were assessed. At Time 1, all psychosocial constructs and at Time 2 smoking cessation was measured. Unless otherwise stated, the response format was a six-point Likert scale ranging from 1 = completely disagree to 6 = completely agree. Table 6 presents means, standard deviations and scale reliabilities.

Volitional self-efficacy was measured by four items adapted from Scholz and colleagues (2009), for example “I am confident that after a lapse I can quit smoking for good even if I… rescheduled my plans several times.”

Action Planning was assessed by five items (Scholz et al., 2009), for example “I have made a detailed plan regarding… when not to smoke.”
Coping Planning was measured by four items (adapted from Sniehotta, Schwarzer et al., 2005), for example “I have made a detailed plan regarding… what to do in difficult situations in order to act according to my intentions.”

Behavioural intentions were assessed by a single item (Scholz et al., 2009): “I intend to quit smoking.”

Smoking-specific received social support was measured by nine items (Burkert, Knoll, & Scholz, 2005). Participants were asked to think of their partner and how he or she reacted with emotional or instrumental support to the participant in the past seven days, for example “My partner … reminded me of strategies, which help me to resist smoking.” or “… comforted me when I was feeling bad because I could not smoke.”

Smoking cessation was assessed in two different ways: a) with a measure of continuous abstinence and b) with biochemical verification of point prevalence. Continuous abstinence was measured by a single self-report item: “Have you smoked since self-set quit date?“. Measures of continuous abstinence are the most rigorous and conservative measures of smoking cessation and are therefore often considered as the gold standard. One argument against this strict measure is that it excludes individuals who will achieve life-long abstinence but who smoke up to a few cigarettes in the first days after the cessation date (Hughes, Keely, Niaura et al., 2003). Therefore participants are often classified as abstinent if they have smoked a maximum of five cigarettes from the start of the abstinence period (West et al., 2005). Considering this argument, the response format in the present study was 1 = No or smoking of maximum 5 cigarettes versus 2 = yes, more than 5 cigarettes. Moreover, as a second measure of smoking cessation, the point prevalence of smoking at T2 was biochemically verified with a carbon monoxide test (CO) of expired air (West et al., 2005). For this test, the Smokerlyzer (Bedfont Instruments, Harrietsham,
UK) was used. This method was chosen as it is non-invasive, valid and not biased by the use of nicotine replacement products, as for example the assessment with salivary cotinine samples is. The usual cut-off point is >9 parts per million (p.p.m.) for indicating smoking (West et al., 2005). In the present study, we therefore categorized participants as 1 = non smokers (≤ 9 p.p.m) versus 2 = smokers (>9 p.p.m.). As carbon-monoxide tests can only detect smoking within the previous approximately 24 hours and are thus measures of point prevalence (i.e., they assess smoking only at a single point in time), they are much less strict than measures of continuous abstinence that assess smoking abstinence over a longer time span.

*Duration between T1 and quit date and duration between quit date and T2* were assessed as potential covariates. As the cessation date was self-set, time between quit date and T1 or T2 varied and was therefore measured in days.

*Social desirability, age* and *sex* were also assessed as potential covariates, as in Switzerland where the study was conducted men and younger individuals smoke more than women and older individuals (Keller et al., 2011). Age was measured in years and sex was coded as 1 = *men* and 2 = *women*. In order to control for potential bias of self-reported smoking cessation, social desirability was assessed by 16 items from the social desirability scale (SDS-17; Stöber & Luther, 2001). The response format was dichotomous with 1 = *do not agree* versus 2 = *agree*, with higher values indicating higher social desirability.
Table 6

*Means, standard deviations, ranges, internal consistency and correlations of main study variables and potential covariates*

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<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
<th>α</th>
<th>Point P</th>
<th>Vol SE</th>
<th>AP</th>
<th>CP</th>
<th>Intent</th>
<th>Support</th>
<th>T1 quit</th>
<th>Quit to</th>
<th>T2 to</th>
<th>Soc D</th>
<th>Age</th>
<th>Sex</th>
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<td>-.10</td>
<td>-.05</td>
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<td>-.14</td>
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<td>-.03</td>
<td>-.02</td>
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<td>.13</td>
<td>.11</td>
<td>-.03</td>
<td>-.28**</td>
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<tr>
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</table>

*Note.* Cont Ab: continuous abstinence, Point P: point prevalence, Vol SE: volitional self-efficacy, AP: action planning, CP: coping planning, intent: behavioural intentions, support: received social support, T1 to quit: duration between T1 and quit date (days), quit to T2: duration between quit date and T2 (days), Soc D: social desirability, Sex: 1 = men, 2 = women. *N* = 106. # p < .10, * p < .05, ** p < .01, *** p < .001.
Data Analyses

At T1, no variable had more than two percent missing values. At T2, the variables assessing smoking cessation showed 7.5% missing values. Numbers of cigarettes smoked at T1, however, were not related to any known mechanism. As there was no significant difference in smoking behaviour at T1 for dropouts and continuers and overall the amount of missing data was very small, listwise deletion of missing cases was applied (Graham, 2009). Outliers were treated in accordance with Tabachnick and Fidell (2001). All analyses were conducted with SPSS 20. Main analyses were logistic regression models. The model contained as predictors the covariate, the self-regulation variables volitional self-efficacy, action planning, coping planning, behavioural intentions, and received social support. To test for moderation, the interactions of support with the three self-regulation variables were entered. The variables were mean-centered to avoid problems with multicollinearity (Cohen et al., 2003). In reporting the moderation models, we also include findings on the 10% significance level. The rationale lies in the sample size, as samples with about 100 participants have limited power for detecting moderation effects (see e.g. McClelland & Judd, 1993). The Johnson-Neyman technique was applied to test the regions of significance of the interaction effects. This technique provides the range of the moderator within which the simple slope of the dependent variable on the predictor is significantly different from zero (Preacher et al., 2006).

Results

Descriptive Statistics

At T1, the average number of daily smoked cigarettes was 16.59 ($SD = 8.52$, range 1-40) and at T2 on average 5.27 ($SD = 6.97$, range 0-40), showing a significant reduction from T1 to T2 ($F(1, 97) = 195.67, p = .001$). According to the measure of continuous abstinence, 34 (32.1%)
participants did not smoke between their quit date and T2. The less strict measure of point prevalence verified by expired carbon monoxide resulted in 67 (63.2%) non-smokers at T2. The 34 participants reporting continuous abstinence were part of the 67 participants identified as non-smokers by point prevalence. The discrepancy between these two measures of smoking cessation can be explained by the participants who reported smoking between their quit date and T2 but were smoke-free at T2 and also by the fact that the biochemically verifiable time window for carbon monoxide is about one day, indicating that participants who did not smoke the day before T2 counted as smoke-free with this measure. There is no practicable way to objectively verify abstinence over a longer time span, but the point prevalence measure provides at least a minimum assurance concerning abstinence at the follow-up point (Hughes, Keely, Niaura et al., 2003; West et al, 2005).

Of the initial 106 participants, 99 (93.4%) completed the T2 follow-up. No significant differences emerged between dropouts and participants who completed both questionnaires regarding action planning, coping planning, smoking behaviour, social desirability, sex, marital status, having children and education. There were significant differences between dropouts and continuers for received social support, $F(1, 103) = 9.90, p = .002$ ($M = 2.25, SD = 1.08$ for dropouts, $M = 3.27, SD = 0.81$ for continuers), volitional self-efficacy, $F(1, 104) = 4.22, p = .043$ ($M = 2.54, SD = 0.86$ for dropouts, $M = 3.37, SD = 0.96$ for continuers) and age, $F(1, 105) = 4.12, p = .045$ ($M = 48.00, SD = 16.15$ for dropouts, $M = 40.15, SD = 9.37$ for continuers). Retired participants were more likely to dropout whereas employed participants were more likely to continue ($\chi^2 (4) = 14.98, p = .005$). However, at T1, the number of missing values in all these variables did not exceed 2%. 
Correlations of volitional self-efficacy, action and coping planning, behavioural intentions, smoking-specific received social support, measures of smoking cessation (continuous abstinence and point prevalence at T2) and the potential covariates duration between T1 and quit date, duration between quit date and T2, social desirability, age and sex are displayed in Table 6. The measures of smoking cessation were positively correlated. Behavioural intentions were correlated negatively with the measures of smoking cessation and positively with action planning and coping planning. The latter two were correlated positively with received social support and were also interrelated. From the potential covariates, sex and duration between quit date and T2 were not correlated with any predictor or outcome variables. Age was only correlated with volitional self-efficacy and social desirability only with social support at the 10% level. Duration between T1 and quit date was associated negatively with volitional self-efficacy, behavioural intentions and social support. As the variability of this time span might have had an effect on the results, duration between T1 and quit date was included as covariate in the regression analyses.

**Main Effects of Self-Regulation and Social Support on Smoking Cessation**

Behavioural intentions emerged as predictor of continuous abstinence (see Table 7) indicating that individuals with higher levels of intentions were more likely to stay abstinent. For point prevalence, however, intentions were not predictive (see Table 8). No main effects of volitional self-efficacy, action planning, coping planning or smoking-specific received social support were observed for either of the smoking cessation measures. There was a tendency that longer duration between baseline assessment and quit date predicted higher likelihood of continuous abstinence (p < .10) in the models for action and coping planning.

**Testing the Joint Effects of Received Social Support and Volitional Self-Efficacy**
To test whether received social support serves a compensating function for low volitional self-efficacy with regard to smoking cessation or whether a synergistic effect emerges, two moderator analyses with the two different measures of smoking cessation were conducted. The first moderator analysis predicted continuous abstinence from the quit date until T2 (see Table 7, first column). The interaction between volitional self-efficacy and smoking-specific received social support was significant at the 10% level (see Figure 5, left panel). It was further investigated by testing the region of significance, applying the Johnson-Neyman technique, resulting in a range of -1.50 to 1.87. These results indicate that for social support values lower than -1.50 and higher than 1.87 the association between volitional self-efficacy and continuous abstinence was significant ($p < .10$). As the minimum and maximum of the mean-centered smoking-specific received social support were -2.20 and 1.94, simple slopes for individuals reporting high and low levels of smoking-specific social support were significant (at the 10% level).

Similar results emerged in the second moderator analysis that predicted biochemically verified point prevalence at T2 (see Table 8, first column). Again, the interaction of volitional self-efficacy and smoking-specific received social support was significant ($p < .05$, see Figure 6). The analysis of the region of significance by the Johnson-Neyman technique showed that the simple slopes were significant only at levels of social support higher than 1.86 ($p < .05$). In sum, the results indicate that those individuals who reported high levels of smoking-specific received social support were more likely to be abstinent the higher their volitional self-efficacy was, indicating a synergistic effect of smoking-specific received social support and volitional self-efficacy. In contrast, individuals reporting lower levels of smoking-specific social support did not benefit from high levels of volitional self-efficacy regarding their smoking abstinence.
Table 7

*Prediction of continuous abstinence by volitional self-efficacy, action planning, coping planning and behavioural intentions moderated by received social support*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$b$</th>
<th>SE $b$</th>
<th>Odds ratio</th>
<th>$b$</th>
<th>SE $b$</th>
<th>Odds ratio</th>
<th>$b$</th>
<th>SE $b$</th>
<th>Odds ratio</th>
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<tbody>
<tr>
<td>Constant</td>
<td>.68</td>
<td>.24</td>
<td>1.98**</td>
<td>.80</td>
<td>.25</td>
<td>2.22***</td>
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<tr>
<td>Duration T1 to quit</td>
<td>-.05</td>
<td>.04</td>
<td>.95</td>
<td>-.07</td>
<td>.04</td>
<td>.94#</td>
<td>-.07</td>
<td>.04</td>
<td>.93#</td>
</tr>
<tr>
<td>Volitional self-efficacy</td>
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<td>.26</td>
<td>1.08</td>
<td>.04</td>
<td>.25</td>
<td>1.05</td>
<td>.09</td>
<td>.26</td>
<td>1.09</td>
</tr>
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<td>Action planning</td>
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<td>.33</td>
<td>.88</td>
<td>-.22</td>
<td>.34</td>
<td>.81</td>
<td>-.27</td>
<td>.34</td>
<td>.77</td>
</tr>
<tr>
<td>Coping planning</td>
<td>.02</td>
<td>.34</td>
<td>1.02</td>
<td>.01</td>
<td>.34</td>
<td>1.01</td>
<td>-.01</td>
<td>.35</td>
<td>1.00</td>
</tr>
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<td>.46</td>
<td>.39*</td>
<td>-1.02</td>
<td>.46</td>
<td>.36*</td>
<td>-.96</td>
<td>.48</td>
<td>.38*</td>
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<td>.34</td>
<td>1.43</td>
<td>.14</td>
<td>.31</td>
<td>1.15</td>
<td>.21</td>
<td>.34</td>
<td>1.24</td>
</tr>
<tr>
<td>Volitional self-efficacy x support</td>
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<td>.37</td>
<td>.52#</td>
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<td></td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
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<td>.27</td>
<td>.68</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Coping planning x support</td>
<td></td>
<td></td>
<td></td>
<td>-.72</td>
<td>.30</td>
<td>.49*</td>
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</table>

*Note.* Support: received social support. $N = 97$. # $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Model volitional self-efficacy x support: $R^2 = .12$ (Cox & Snell), .17 (Nagelkerke); model action planning x support: $R^2 = .11$ (Cox & Snell), .15 (Nagelkerke); model coping planning x support: $R^2 = .16$ (Cox & Snell), .21 (Nagelkerke).
Table 8

*Prediction of point prevalence by volitional self-efficacy, action planning, coping planning and behavioural intentions moderated by received social support*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Point prevalence (T2)</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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<tr>
<td></td>
<td>b</td>
<td>SE</td>
<td>Odds ratio</td>
<td>b</td>
<td>SE</td>
<td>Odds ratio</td>
<td>b</td>
</tr>
<tr>
<td>Constant</td>
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<td>0.25</td>
<td>0.40***</td>
<td>-0.75</td>
<td>0.24</td>
<td>0.47**</td>
<td>-0.73</td>
</tr>
<tr>
<td>Duration T1 to quit</td>
<td>0.02</td>
<td>0.04</td>
<td>1.02</td>
<td>0.01</td>
<td>0.04</td>
<td>1.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Volitional self-efficacy</td>
<td>0.12</td>
<td>0.28</td>
<td>1.13</td>
<td>0.01</td>
<td>0.26</td>
<td>1.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Action planning</td>
<td>-0.54</td>
<td>0.37</td>
<td>0.58</td>
<td>-0.56</td>
<td>0.36</td>
<td>0.57</td>
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<tr>
<td>Coping planning</td>
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<td>0.37</td>
<td>1.64</td>
<td>0.43</td>
<td>0.35</td>
<td>1.54</td>
<td>0.48</td>
</tr>
<tr>
<td>Behavioural intentions</td>
<td>-0.44</td>
<td>0.39</td>
<td>0.64</td>
<td>-0.45</td>
<td>0.38</td>
<td>0.64</td>
<td>-0.43</td>
</tr>
<tr>
<td>Received social support</td>
<td>0.55</td>
<td>0.36</td>
<td>1.74</td>
<td>0.23</td>
<td>0.31</td>
<td>1.26</td>
<td>0.28</td>
</tr>
<tr>
<td>Volitional self-efficacy x support</td>
<td>-0.80</td>
<td>0.38</td>
<td>0.45*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action planning x support</td>
<td></td>
<td></td>
<td></td>
<td>-0.34</td>
<td>0.29</td>
<td>0.71</td>
<td></td>
</tr>
<tr>
<td>Coping planning x support</td>
<td></td>
<td></td>
<td></td>
<td>-0.49</td>
<td>0.31</td>
<td>0.62</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Support: received social support. N = 97. # p < .10, * p < .05, ** p < .01, *** p < .001. Model volitional self-efficacy x support: $R^2 = .13$ (Cox & Snell), .18 (Nagelkerke); model action planning x support: $R^2 = .09$ (Cox & Snell), .13 (Nagelkerke); model coping planning x support: $R^2 = .11$ (Cox & Snell), .15 (Nagelkerke).
Testing the Joint Effects of Received Social Support and Action and Coping Planning

With the same data analytic approach as described above, we tested whether received social support moderates the association between action and coping planning and smoking cessation. Action planning did not show an interaction with received social support, neither for continuous abstinence nor for point prevalence (see Table 7 and Table 8, second column).

Coping planning showed an interaction with received social support for continuous abstinence ($p < .05$, see Table 7, third column). The analysis of the region of significance by the Johnson-Neyman technique showed that the simple slopes were only significant at levels of social support higher than 1.65 ($p < .05$). As the maximum of the mean-centered smoking-specific received social support was 1.94, simple slopes were only significant for individuals reporting high levels of smoking-specific received social support. For these individuals a very similar picture as with volitional self-efficacy emerged (see Figure 5, right panel): the combination of high coping planning and high social support was related to successful continuous abstinence, indicating a synergistic effect. Individuals reporting low levels of smoking-specific social support did not benefit from high levels of coping planning regarding their smoking cessation. In a second moderator analysis predicting biochemically verified point prevalence at T2, there was no interaction between coping planning and received social support (see Table 8, third column).

Discussion

This study aimed at testing the role of smoking-specific received social support in combination with individual self-regulation in smoking cessation. To our knowledge, this study was the first that examined the joint effects of individual and social regulation in the context of smoking cessation. Two alternative hypotheses were tested: a) the potentially compensating
Figure 5. Interaction of volitional self-efficacy / coping planning and received social support on continuous abstinence (0 = abstinence, 1 = smoking). Low social support shown for the empirical minimum (1), high social support for the empirical maximum (5.14).
function of received social support for low levels of individual regulation or b) potential synergistic effects of individual regulation and social support.

Although we did not find direct effects of volitional self-efficacy, coping planning or smoking-specific received social support on continuous abstinence, the interaction terms of volitional self-efficacy and coping planning by smoking-specific received social support emerged as relevant predictors. Results indicate a rejection of the compensation hypothesis and rather emphasize a synergistic relationship. Individuals with high levels of received social support from their non-smoking partner are more likely to stay abstinent, the higher their volitional self-efficacy / coping planning was. Thus, the results from Warner and colleagues (2011) which demonstrated that for multi-morbid individuals with lower self-efficacy received social support served a compensating function with regard to perceived autonomy could not be transferred to the context of smoking cessation. Our findings rather indicated that the stressful and taxing
situation of quitting smoking requires a combination of self-regulatory and social resources, whereas the compensation of weaker self-regulatory resources (volitional self-efficacy, coping planning) by means of received social support may be not sufficient to successfully implement an intention to quit smoking. This might indeed be an effect of the difficulty of the behaviour: stopping smoking is known to be extremely difficult with relapse rates of over 70% after one month (Hughes, Keely, & Naud, 2003). As reported above, this was quite similar in the present study. Thus, future studies should examine whether the need for high levels of received social support together with high levels of self-regulation competence is possibly less pronounced for health behaviours that are easier to implement, such as making a medical appointment.

Results for the two outcome measures of smoking cessation (self-reported continuous abstinence and biochemically verified point prevalence of abstinence) differed slightly in that the interaction effect between received support and coping planning did not gain significance for the measure of point prevalence. This measure, albeit objectively measured, is less strict than the measure of continuous abstinence. As a consequence, almost half of the people classified by this measure as non-smokers at T2 were by self-report not continuously abstinent. In contrast, individuals who claimed continuous abstinence were also verified by this objective point prevalence measure. Thus, results of the continuous abstinence measure can be trusted.

Of the three volitional constructs considered, only action planning did not interact with received social support. A potential explanation could lie in the nature of this construct and this study’s design: action planning refers to specific plans about when, where and how to quit smoking. The participants in the current study set themselves a quit date which was very strict because of the study design. They showed high commitment to this date and therefore probably action planning was already obsolete. Another explanation might lie in the fact that most of the
participants (81.6%) had already tried to quit smoking prior to the study. Action planning could have been more important for individuals on their first quit attempt, as most participants in the current study were experienced in planning the cessation. As several studies demonstrated (Hughes, Keely, & Naud, 2003), most of the smokers manage not to smoke a few days after the cessation date but then fail to maintain their smoke-free status and have relapses when difficult situations in their daily life arise. Our findings suggest that these situations can be managed with a combination of social support and coping planning which therefore seems to be of greater importance for continuous abstinence than action planning.

Some limitations of the current study need to be addressed. Assessing smoking cessation regarding continuous abstinence as the dependent variable was self-reported. Self-reported variables might bias the validity of the assessment. However, in the context of smoking cessation, self-report is highly accurate except for clinic or other intensive intervention studies and high-risk or medical patients (Velicer, Prochaska, Rossi, & Snow, 1992). As the study sample did not include high-risk or medical patients, self-reported continuous abstinence in the present study should be reasonably accurate. In addition, to account for potential bias, social desirability was assessed. The association between smoking cessation and social desirability was close to zero. Thus, it can be assumed that the self-reported smoking cessation is at least not biased by social desirability. Additionally smoking status at the follow-up was biochemically verified and yielded similar results. Another limitation were the rather small effects, the findings should therefore be replicated. As the sample of the present study consisted of heterosexual smokers who were committed to and cohabited with a non-smoking partner, generalisability of the results might be limited (e.g. regarding couples with both partners smoking and wanting to quit). Further replication studies should test different samples and also different health behaviours. Finally, the
current longitudinal study included both self-regulation and received social support as perceived by the smoker. In future studies, it would be valuable to use an intensive longitudinal design including close others to get a more fine-grained picture of the effects of self-regulation and close relationships on health in daily life (Stadler, Snyder, Horn, Shrout, & Bolger, 2012).

Despite these limitations, this study has important theoretical and practical implications. The results provide first evidence that the combination of individual and social factors is helpful for successfully quitting smoking. From a theoretical point of view, these findings argue for combining the two lines of research that have mostly been independently examined so far: models of individual health behaviour change and the role of received social support in health behaviour change (e.g., Scholz, Ochsner, Hornung et al., 2013). Moreover, as this study demonstrates, the interplay of individual and social factors might be of even greater importance than mere main effects. From a practical perspective, interventions on smoking cessation should strengthen individual resources but also include the social environment; especially since smoking is a behaviour often performed in company and affecting the social environment. As people who live with a smoking partner have an increased risk for several diseases compared to those living with a non-smoker (Law et al., 1997), providing social support to help the partner to quit smoking is also beneficial for themselves.

Concluding, the study yielded first evidence for the importance of the combination of individual and social factors in smoking cessation. Future research should explore these findings further and develop interventions to provide smokers who intend to quit with the best possible conditions.
Footnote

1Participants and their partners were invited to the authors’ lab in order to ensure couples completing the smoker and partner questionnaires in separate rooms. Moreover, biochemical verification of smoking status necessitated couples to come to the lab. In this study, focus is on smokers only.

Acknowledgements

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