



Self-Regulation and Health Behavior Across the Life Span

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Abstract

Health behaviors are generally known to improve an individual's health status and reduce the probability of a wide range of diseases. It is widely accepted that psychological models or theories are necessary to understand better ways of behavior change. The aim of this thesis was to determine the effectiveness of social-cognitive factors on different health behaviors (i.e., fruit and vegetable intake, physical activity, and dental hygiene) among Iranian samples with a wide range of age groups from adolescents to older adults on the basis of the Health Action Process Approach (HAPA).

We have conducted studies focusing on increasing vegetable intake among young children and fruit consumption among women and, in addition, one study was performed focusing on increasing the incidence of dental flossing among adolescent girls, all in Iran with self-regulatory interventions; and finally a meta-analysis was performed to synthesize the outcomes of studies that have been conducted to understand the associations between social-cognitive variables and physical activity on the basis of the HAPA.

The theory-guided intervention designs have further elucidated the mechanisms of changing health behaviors (i.e., fruit and vegetable intake and dental flossing). The findings may have accumulated the knowledge about self-regulatory and social-cognitive components in health behavior change. Our findings in the meta-analyses showed that except from risk perception, all the social-cognitive constructs of HAPA (i.e., outcome expectancies, self-efficacy, intention, planning, and action control) had significant and large associations among each other and with physical activity.

Determining the most effective constructs is useful when it comes to design health behavior promotion programs. However, a theory guided structure of associations can help to improve the quality of such applications.

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Introduction

Introduction

Health behaviors are generally known as the behaviors that improve an individual's health and reduce the probability of a wide range of diseases. It is widely accepted that psychological models or theories are necessary to better understand the ways of changing behavior. Thus, theories have been explicitly used as the basis for the design of interventions, to explain the structural and psychological determinants of health promotion behaviors, and to contribute to health promotion practices. Theories of health behavior change focus on various determinants of behavior at different levels such as individual, interpersonal, group, organizational, and/or community (Painter, Borba, Hynes, Mays, & Glanz, 2008).

Various social-cognitive factors are associated with health behaviors. There are a number of social-cognitive theories and models that describe how people engage in the behavior change process including, the Health Belief Model (HBM) (Rosenstock, 1974), the Social Cognitive Theory (SCT) (Bandura, 1977), the Theory of Planned Behavior (TPB) (Ajzen, 1991), or the Health Action Process Approach (HAPA) (Schwarzer, 2008).

The major aim of this thesis is to determine the effectiveness of social-cognitive factors and self-regulatory skills on different health behaviors (i.e., fruit and vegetable intake, physical activity and dental hygiene) among Iranian samples; taking on a life span perspective, this thesis contains a wide range of age groups from adolescents to older adults.

In this chapter, a review of the theoretical frameworks is followed by a summary and integration of recent literature, which provides the rationale for selecting the model to evaluate the central assumptions guiding this thesis. Finally, the research questions that are addressed in the empirical chapters of this thesis (*Chapters 2-5*) are outlined.

Social-cognitive approaches to health behavior

It has been decades that psychologists have become interested in using psychological factors in predicting behavior change. One of the first attempts at explaining health behavior change was the health belief model (HBM) (Rosenstock, 1974). The HBM is a staged theory, and each step in the decision making process is dependent on the previous decision or belief. An individual must believe that s/he is susceptible to a condition; the condition is serious; there is an intervention for the condition that is helpful; and s/he can overcome all barriers to carry out the intervention. The HBM, however, has ignored important dimensions of individuals' behavior such as, the belief in one's own competence to successfully change behavior, which later led to its contribution to self-efficacy as a motivational component in the theory (Rosenstock, Strecher, & Becker, 1988).

The social cognitive theory (SCT) is based on the assumption that psychological constructs, namely self-efficacy and outcome expectancy, serve as predictors of individuals' behavior (Bandura, 1977). Outcome expectancy is defined as a person's estimate that a specific behavior will lead to certain outcomes; which could be a positive outcome like staying fit by regular exercise, or a negative outcome such as developing heart disease as a consequence of eating unhealthily and not doing exercise. Self-efficacy refers to the expectation that one can successfully perform a behavior required to generate specific outcomes. According to SCT, one's expectations affect both initiation of and persistence in behavior. Not only can perceived self-efficacy have direct effects on initiating of activities, but by means of expectations of eventual success, it can affect continuing efforts once they are initiated. Self-efficacy determines how much effort people will expend and how long they will persist when facing obstacles (Bandura, 1977).

The theory of planned behavior (TPB) (Ajzen, 1991) is considered as a social cognition model of decision-making; it is an extension of the theory of reasoned action (Ajzen

& Fishbein, 1980; Fishbein & Ajzen, 1975). It postulates that a central factor to perform a given behavior is an individual's intention. Intentions are assumed to capture the motivational factors that affect behavior; the stronger the intention to perform a certain behavior the more likely its accomplishment. According to the TPB, behavioral intention is the most proximal antecedent of health-related behaviors (Buunk-Werkhoven et al., 2009; Fishbein & Ajzen, 2010; McCaul, O'Neill, & Glasgow, 1988). Although intention is the strongest predictor of behavior, it is not sufficient to explain and predict behavior: not all of those who intend to perform a health behavior actually do so. For example, a study by Blanchard and colleagues (Blanchard, Courneya, Rodgers, & Murnaghan, 2002) indicated that intention explained 36% of the variance in exercise behavior. While Sheeran and Orbell (1998) reported a mean correlation of .44 between intention and behavior with a meta-analysis on 28 studies of condom use.

To bridge this so-called intention-behavior-gap, it has been suggested that forming specific action plans of when, where and how to act can increase the likelihood of successful implementation of one's intention. According to the health action process approach (HAPA) (Schwarzer, 2008), to adhere to the recommendations for health behaviors, one has to become motivated to do so, and if one is motivated, one needs additional self-regulatory skills and behaviors such as, planning to translate a behavioral intention into action. Accordingly, the HAPA model (see Figure 1) suggests a distinction between (a) pre-intentional motivational processes that lead to a behavioral intention (motivational phase), and (b) post-intentional volitional processes that lead to the actual health behavior (volitional phase). In the motivation phase, an individual develops an intention to act. In this phase, risk perception sets the stage for elaboration of thoughts about consequences and competencies. Outcome expectancies pertain to the perceived consequences of one's actions. Further, perceived task self-efficacy operates

jointly with outcome expectancies and risk perception to form a behavioral intention (Schwarzer, 2008).

When a person is inclined to adopt a particular health behavior, the intention has to be transformed into detailed plans on how to perform the desired action. Once an action has been initiated, it has to be maintained. This is not achieved through a single act of will, but involves self-regulatory skills and strategies. Thus, the post-intentional phase is further broken down into more proximal factors, such as *planning*, *maintenance self-efficacy*, *recovery self-efficacy*, and *action control*. Two types of planning have been introduced: action planning (when, where, and how to act) and coping planning (to identify barriers and strategies to cope with them) (Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Whereas planning is a prospective strategy, that is, behavioral plans are made before the situation is encountered, action control is a concurrent self-regulatory strategy, where the ongoing behavior is continuously evaluated with regard to a behavioral standard.

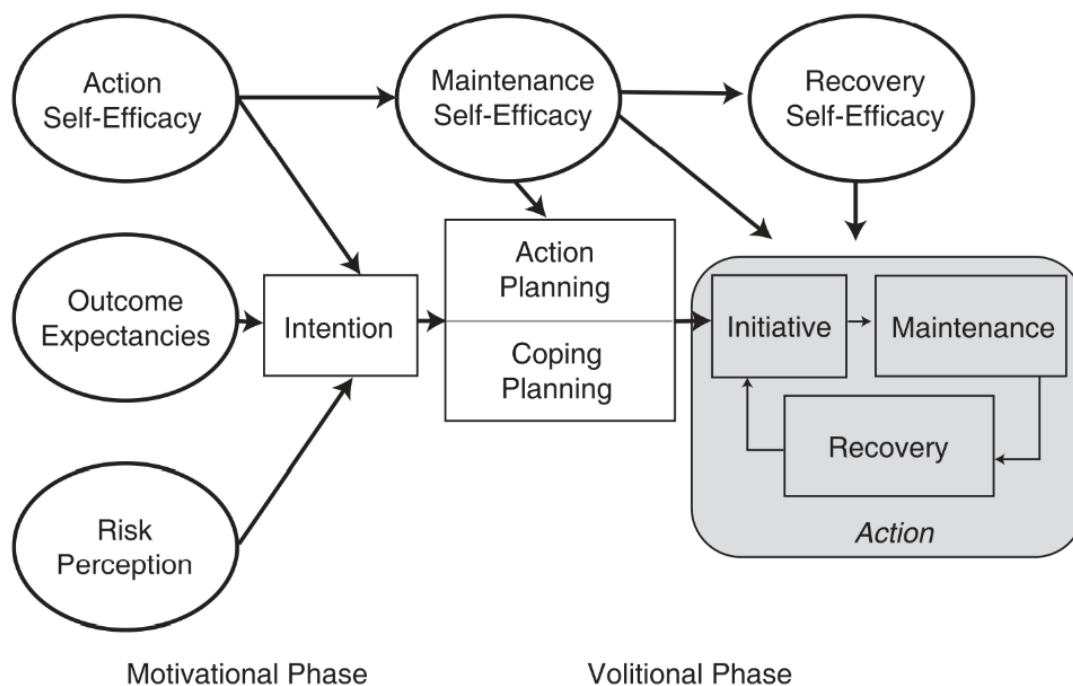


Figure 1. Health Action process Approach (HAPA; Schwarzer, 2008)

Application of self-regulatory constructs to promote health behaviors

Some studies employ multiple social-cognitive variables to evaluate the associations among them and health behaviors (Fleig et al., 2013; Godinho, Alvarez, Lima, & Schwarzer, 2013; Schwarzer, Antoniuk, & Gholami, 2014; Warner et al., 2013). Besides these, there are studies that follow a defined structure according to social-cognitive models as a rationale for choosing constructs and arranging their relationships in the process of analyzing and assessment of outcomes (Ar-Yuwat, Clark, Hunter, & James, 2013; Berli, Loretini, Radtke, Hornung, & Scholz, 2013). In the following, we review studies which investigated the relationships between self-regulatory constructs and various health behaviors.

Healthy nutrition

A balanced diet low in fat and rich in fiber and vitamins can facilitate health, physical fitness, and maintain body weight. However, dietary habits are difficult to change (Adriaanse, Gollwitzer, De Ridder, de Wit, & Kroese, 2011; Verhoeven, Adriaanse, Evers, & de Ridder, 2012). Even if people have enough information about health-behavior recommendations and are motivated to follow a healthy lifestyle, they still need self-regulatory strategies to translate their intention into action, as many studies on health behavior change indicated (Luszczynska, Tryburcy, & Schwarzer, 2007b; Schwarzer, 2008; Wiedemann, Lippke, & Schwarzer, 2012). Stadler, Oettingen, and Gollwitzer (2010), for example, provided evidence that self-regulatory techniques were effective for maintaining dietary change over two years among women. More precisely, adding planning components to interventions has induced larger effects than interventions based solely on information provision (Stadler et al., 2010). Similarly, in the study by (Luszczynska & Haynes, 2009) planning led to an average increased fruit and vegetable consumption of 0.45 servings among student nurses and midwives.

A meta-analysis has documented the role of planning in dietary changes (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011). Planning can be promoted effectively among individuals with self-regulatory deficits (Adriaanse et al., 2010). Planning facilitates the translation of intention into action. Studies have, therefore, specified planning as a mediator (Renner et al., 2008; Richert et al., 2010). Hunter, McNaughton, Crawford, and Ball (2010) provided evidence of a mediating effect of dietary planning on fruit consumption among women. Several randomized controlled trials have documented the evidence in favor of such planning interventions in the context of dietary changes (Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2011; Kellar & Abraham, 2005; Luszczynska, Tryburcy, & Schwarzer, 2007a; Wiedemann et al., 2012).

Not only is it important to encourage adults to improve their nutrition habits by means of self-regulatory skills; the increasing prevalence of childhood overweight makes children an important target for health-promotion programs as well. Nutrition patterns in childhood predict food consumption in adolescence (Cutler, Flood, Hannan, & Neumark-Sztainer, 2009) and adulthood (Singer, Moore, Garrahe, & Ellison, 1995). Thus, establishing healthy eating patterns in childhood should decrease health risk factors later in life. There is evidence that dietary preferences and intake patterns are learned by children at young ages, with parents being a primary influence on nutrition habits (Benton, 2004). Parents are responsible for what young children are offered to eat and for building their food intake preferences (Birch, 2006). These childhood dietary patterns in turn, track into adulthood and may be critical in the development of obesity (Savage, Fisher, & Birch, 2007).

Early interventions within the family environment are an effective strategy for childhood obesity prevention (Haire-Joshu et al., 2008) and for the development of favorable food attitudes and eating behaviors of children and adolescents (Campbell et al., 2007). In a

review, Blanchette and Brug (2005) have found that parental eating behaviors have the strongest impact on what a child consumes.

Johannsen, Johannsen, and Specker (2006) have shown that both mothers and fathers influence the food attitudes and eating behaviors of their children; however, mothers in comparison to fathers, seem to be more concerned about their children's diet and have the strongest influence on their children's eating behaviors. Although education interventions may provide a means for teaching parents how to provide a positive food environment for their children, few studies have addressed the effectiveness of home-based approaches and their influence on parent to child fruit and vegetable intake (LaRowe, Wubben, Cronin, Vannatter, & Adams, 2007).

Dental hygiene

Oral disease, such as dental caries, periodontal disease, and tooth loss, is an alarming public health problem (Petersen, 2008). A review of the epidemiological data from many countries clearly indicates that a global increase in dental caries prevalence affects children as well as adults (Bagramian, Garcia-Godoy, & Volpe, 2009).

Dental caries can be prevented or reversed in most people by regular oral hygiene home care and clinical preventive procedures. Daily flossing has been proven to prevent periodontal disease, tooth decay, and tooth loss (Gangi, Sherman, & White, 2011). Although adherence to such oral hygiene behaviors (e.g. tooth brushing and flossing) is required, studies indicate that a significant proportion of people brush and floss their teeth less than recommended (Ramsay, 2000; Schüz, Sniehotta, Wiedemann, & Seemann, 2006) that is, people fail to sufficiently change this health behavior.

A number of social cognitive predictors have been shown to be related to oral hygiene behaviors. These include action planning and coping planning (Munster Halvari, Halvari,

Bjornebekk, & Deci, 2012; Pakpour, Hidarnia, Hajizadeh, & Plotnikoff, 2012; Pakpour & Sniehotta, 2012; Schüz et al., 2006; Schüz, Wiedemann, Mallach, & Scholz, 2009), self-efficacy (Anagnostopoulos, Buchanan, Frousiounioti, Niakas, & Potamianos, 2011; Buglar, White, & Robinson, 2010; Pakpour & Sniehotta, 2012; Schwarzer et al., 2014) and intention (Pakpour & Sniehotta, 2012; Sniehotta, Araujo Soares, & Dombrowski, 2007). In addition, studies have reported beneficial effects of social-cognitive related interventions on increasing oral hygiene behaviors (Munster Halvari et al., 2012; Schwarzer et al., 2014; Schwarzer et al., 2007; Sniehotta et al., 2007).

Physical activity

Engaging in regular physical activity is associated with health benefits, in contributing to the development of a healthy cardiovascular system, musculoskeletal tissues, neuromuscular awareness and facilitating the maintenance of a healthy body weight (WHO, 2011). However, the adoption and maintenance of physical activity is a challenging task and even despite having the intentions, many people fail to adhere or maintain regular physical activity (Sheeran, 2002).

Various social-cognitive determinants have been investigated to understand and predict engaging in regular physical activity or physical exercise. Depending on the theoretical background, those social-cognitive constructs can vary in different studies. Major constructs that are studied in relation with predicting or improving physical activity and exercise are self-efficacy (Higgins, Middleton, Winner, & Janelle, 2013; Parschau et al., 2013; Williams & French, 2011), planning (Carraro & Gaudreau, 2010, 2013; Koring et al., 2012; Reuter et al., 2010; Sniehotta, Gorski, & Araújo-Soares, 2010; Ziegelmann, Lippke, & Schwarzer, 2006), and self-regulation (Koring et al., 2013; Matthews & Moran, 2011; Schüz, Wurm, Warner, Wolff, & Schwarzer, 2013; Stadler, Oettingen, & Gollwitzer, 2009). Studies have indicated that social-cognitive related interventions are successful in promoting attendance in physical

activities (Evers, Klusmann, Ziegelmann, Schwarzer, & Heuser, 2012; Higgins et al., 2013; Luszczynska, Schwarzer, Lippke, & Mazurkiewicz, 2011; Schwarzer, Cao, & Lippke, 2010; Skår, Sniehotta, Molloy, Prestwich, & Araújo-Soares, 2011).

Research aims and questions in this thesis

The current thesis is designed to understand the associations between self-regulatory variables and health behaviors on the basis of the Health Action Process Approach among a wide range of age groups from adolescence to old adulthood. In more detail, this thesis focused on investigating the following research questions:

- 1) We investigated the psychological mechanisms through which a self-regulatory intervention leads to an increase in desired health behavior. It was expected that the intervention group not only scores higher in self-regulatory strategies, but also reports higher levels of the health behavior later on (*Chapter 3, 4*).
- 2) Another question addressed the effectiveness of a self-regulatory treatment; it was expected that changes in social cognitive mediators that were directly addressed in the interventions such as behavioral intention (*Chapter 3*), self-efficacy (*Chapter 3*), and planning (*Chapter 2, 3, 4*), would operate as mediators between the experimental conditions and the health behavior.
- 3) It was investigated whether age makes a difference on effectiveness of such interventions on increasing health behaviors (*Chapter 3, 4*).
- 4) Finally, a meta-analysis was conducted (*Chapter 5*) to understand the associations between social-cognitive variables and physical activity on the basis of the health action process approach (HAPA) (Schwarzer, 2008).

Studies in this thesis

We have conducted two studies with self-regulatory interventions focusing on increasing fruit and vegetable intake among women and young children in Iran; and also one study focusing on increasing the incidence of dental flossing among adolescent Iranian girls; finally a meta-analysis was performed to synthesize the outcomes of studies that have been conducted to understand the associations between social-cognitive variables and physical activity on the basis of the HAPA.

In the first study (*Chapter 2*) self-regulation intervention for mothers was supposed to help increase vegetable consumption in their daughters in a primary school. A randomized controlled trial compared a self-regulation intervention with controls in 155 mothers (aged 25-50 years). The primary outcome was children's vegetable consumption that was reported by their mothers at three points in time, at baseline (Time 1), 2 weeks later (Time 2) and at 3-month follow-up (Time 3).

In the second study (*Chapter 3*) we have collected data from female adolescents in Iran. Self-regulatory mechanisms in oral hygiene were studied by a brief intervention design to increase the frequency of dental flossing among school-aged girls. A cluster randomized controlled trial compared an intervention with a control condition in 166 girls, aged 11-15 years. Primary outcome was dental flossing, whereas planning, self-efficacy, and the behavioral intention served as mediators. At baseline (Time 1), the intervention group received theory-guided materials on dental flossing. Changes were assessed after four weeks (Time 2).

In the third study (*Chapter 4*), we examined whether a dietary planning intervention focusing on self-regulatory mechanisms in behavior change would help increase fruit consumption among Iranian women. A randomized controlled trial compared a planning intervention with a control condition in 165 Iranian women (aged 17-48 years). Primary outcome was fruit intake, and dietary planning served as the mediator. After baseline

assessment (T1) the intervention group received a leaflet on fruit consumption with a planning sheet. Changes were assessed at 3-week (T2) and at 3-month follow-ups (T3).

The final study (*Chapter 5*) was a meta-analysis that aimed to synthesize the outcomes of published studies that have investigated the 21 associations among social-cognitive constructs and physical activity on the basis of the Health Action Process Approach (HAPA). A systematic literature search has been conducted for HAPA-based articles that reported associations between social-cognitive constructs and physical activity including cross-sectional, longitudinal, and experimental research designs.

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2

Mothers Improve their Daughters' Vegetable Intake: A Randomized Controlled Trial

Gholami, M., Wiedemann, A., Knoll, N., & Schwarzer, R. (2014). Mothers improve their daughters' vegetable intake: A randomized controlled study. *Psychology, Health & Medicine*. Advance online publication. <http://dx.doi.org/10.1080/13548506.2014.902485>

3

A Brief Self-regulatory Intervention Increases Dental Flossing in Adolescent Girls: A Randomized Controlled Trial

Abstract

Objectives: Self-regulatory mechanisms in oral hygiene are studied by a brief intervention design to increase the frequency of dental flossing among school-aged girls.

Method: A cluster randomized controlled trial compared an intervention with a control condition in 166 girls aged 11-15 years. Dependent variable was dental flossing, whereas planning, self-efficacy, and the behavioral intention served as mediators. At baseline, the intervention group received theory-guided materials on dental flossing. Changes were assessed after four weeks.

Results: The brief self-regulatory intervention led to an increase in dental flossing. Changes in self-efficacy as well as in intention, but not in planning, mediated between treatment conditions and outcomes.

Conclusion: Self-efficacy and intention seem to play a mediating role in the mechanism that facilitates dental flossing among adolescent girls. Interventions that aim at an improvement of oral hygiene should consider use of components that combine motivation with self-confidence.

Keywords: self-regulation intervention; intention; self-efficacy; dental flossing; adolescents.

Introduction

Oral disease, such as dental caries, periodontal disease and tooth loss, is an alarming public health problem (Petersen, 2008). A review of the epidemiological data from many countries clearly indicates that a global increase in dental caries prevalence affects children as well as adults (Bagramian, Garcia-Godoy, & Volpe, 2009). Despite the improvement in oral health of children in the last few decades, tooth decay remains one of the most common childhood diseases, in both industrialized and developing countries (Petersen, 2008).

Dental caries can be prevented or reversed in most people by regular oral hygiene home care and clinical preventive procedures. Daily flossing has been proven to prevent periodontal disease, tooth decay and tooth loss (Gangi, Sherman, & White, 2011). Although adherence to such oral hygiene behaviors (e.g. tooth brushing and flossing) is required, studies indicate that a significant proportion of people brush and floss their teeth less than recommended (Ramsay, 2000; Schüz, Sniehotta, Wiedemann, & Seemann, 2006) that is, people fail to sufficiently change this health behavior.

Various psychosocial factors are associated with health behavior change. According to the reasoned action approach (RAA) (Fishbein & Ajzen, 2010), behavioral intention is the most proximal antecedent of health-related behaviors (Buunk-Werkhoven et al., 2009; McCaul, O'Neill, & Glasgow, 1988). Moreover, social cognitive theory (SCT) (Bandura, 1977) indicates that self-efficacy (i.e., confidence in one's ability to execute a challenging behavior) predicts a range of health behaviors including oral self-care (Buglar, White, & Robinson, 2010; Schüz et al., 2006; Stewart, Wolfe, Maeder, & Hartz, 1996). It suggests that individuals' stronger self-efficacy for adopting oral self-care, would be associated with a better oral health status (Anagnostopoulos, Buchanan, Frousiounioti, Niakas, & Potamianos, 2011; Buglar et al., 2010; Morowatisharifabad, Shirazi, & Karimzadeh, 2007; Yekaninejad et al., 2012).

According to the health action process approach (HAPA), to adhere the recommended health behaviors, one has to become motivated by means of psychological elements such as intention and behavioral self efficacy, and then one needs additional self-regulatory skills and behaviors such as action planning and coping planning to translate an intention into action (Schüz, Wiedemann, Mallach, & Scholz, 2009; Schwarzer, 2008). Although intention is the strongest predictor of behavior, it is not sufficient to explain and predict behavior; approximately only half of those who intend to perform a health behavior actually do so (Sheeran & Orbell, 1998).

To bridge this so-called intention-behavior-gap, it has been suggested that forming specific action plans of when, where and how to act can increase the likelihood of successful implementation of one's intention. Advance planning forms a mental link between specific situational cues and behavioral responses, enhancing the accessibility of relevant cues and decreasing the likelihood of forgetting or missing of opportunities (Gollwitzer, 1999). Two types of planning have been introduced; action planning (when, where and how to act) and coping planning (to identify barriers and strategies to cope with them) of the intended behavior (Sniehotta, Schwarzer, Scholz, & Schüz, 2005). Studies have reported beneficial effects of action planning and coping planning on dental flossing (Munster Halvari, Halvari, Bjornebekk, & Deci, 2012; Schüz et al., 2006; Schüz et al., 2009). Pakpour and Sniehotta (2012), have indicated that intention, perceived behavioral control (which is similar to self-efficacy), action planning and coping planning are associated with higher frequency in dental brushing among adolescents.

Aims of the study

The present study investigates an oral health intervention focusing on dental flossing among school-aged girls. The research question addresses the effectiveness of a brief self-

regulatory treatment as compared to a passive control condition. The experimental group learns several self-regulatory strategies that include forming a behavioral intention, developing self-efficacy and carrying out action as well as coping planning. The primary outcome variable is dental flossing. Secondary outcome variables are the behavioral intention, self-efficacy, and planning. Another research question concerns the active ingredients of the treatment. Do behavioral intention, self-efficacy, and planning operate as mediators between the experimental conditions and dental flossing behavior?

Method

Participants and procedure

A brief self-regulation intervention focusing on dental flossing was conducted among adolescent girls over a time span of one month in December 2012 with two assessment points in time. The experiment followed APA ethical principles regarding research with human participants.

Participants were invited to the study through school boards. Attending the program was voluntary. A total of 166 female students were recruited and allocated to an intervention ($n=69$) and a control group ($n=97$) by cluster randomization. Participants were blinded about the allocation throughout the study. The pre-test (Time 1; T1) questionnaires included socio-demographic information (e.g., age, school class) and socio-cognitive variables as well as dental flossing frequency. Only the intervention group received the intervention package (see below). The post-test (Time 2; T2) questionnaires were filled out by participants after two weeks. Mean age of the longitudinal sample was 12.5 years with $SD=1.14$ and a range from 11 to 15 years, from grade 5 to 8.

Measures

Dental flossing, intention, and self-efficacy were assessed with one item each, using an open answer format. Current dental flossing: “How many times in the past week did you use dental floss?” *Intention*: “How many times per week do you intend to floss from now on?” *Self-efficacy*: “How many times per week are you sure that you can floss from now on?”

Action planning and coping planning were measured by one item each. Action planning: “I have planned exactly, where and when to floss my teeth for the next four weeks.”, and coping planning: “If I miss the opportunity to floss as I planned, I will do the flossing later in the same day or next morning.” Responses were rated on a scale ranging from (1) *not at all true* to (4) *exactly true*.

Intervention and control conditions

In the experimental condition, participants received an intervention package at the end of their pre-test questionnaire. According to the behavior change technique definitions by Michie et al. (Michie et al., 2011), the intervention consisted of providing normative information about others’ behavior, and also on providing information on where and when to perform the behavior. Moreover, the intervention included planning exercises for dental flossing (action planning) as well as barrier identification and problem solving. Participants were asked specifically to generate plans for two occasions with specifying the place and the time that they wanted to floss their teeth (by the specifying time and location). Moreover, they were asked to generate two situations which may impede the planned behavior, and a strategy to overcome the barriers (for example, “If I cannot floss right after lunch because I am out... then I floss when I come home in the afternoon.”).

In the control condition, participants only received the questionnaires at two assessment points without an intervention.

Analytical procedure

All analyses were run with SPSS 20. Randomization checks tested baseline differences between participants in the two study conditions by means of ANOVAs for continuous and χ^2 tests for categorical measures.

To examine intervention effects, repeated measures analyses of variance were computed with dental flossing, intention, self-efficacy, action planning and coping planning as dependent variables at two points in time, and experimental conditions as the between-subjects factor.

A mediation model to predict post-test dental flossing was specified with baseline flossing as a covariate, using the PROCESS macro by Hayes (Hayes, 2013). Sequential mediation was specified by an effect of treatment on intention change, intention change on self-efficacy change, and self-efficacy change on dental behavior. Residual scores of intention and self-efficacy served as mediators. Confidence intervals were determined by the bootstrapping procedure, using 5,000 resamples.

Results

Drop-out analyses and missingness

There was no participant drop out, but some values were missing with rates between only 1.2% and 4.8%, except from dental flossing in both pre-test and post-test assessments with 5.4% of missing values; Therefore, missing values were imputed by the expectation maximization method in SPSS 20.

Randomization check

Results revealed no baseline differences across the two study conditions regarding dental flossing, intention and self-efficacy, action planning, coping planning, and age (all $p > .05$).

Intervention effects

Means, standard deviations, and group comparison statistics for all variables are summarized in Table 1.

Table 1. Means and Standard Deviations (SD) of dental flossing, intention, and self-efficacy, in both groups, and comparison between groups

Variable / Group	Pre-test					Post-test				
	Mean	SD	<i>t</i>	<i>p</i>	<i>d</i>	Mean	SD	<i>t</i>	<i>p</i>	<i>d</i>
Flossing			.43	.66	.06			2.47	.01	.37
Intervention	6.23	6.38				7.87	7.18			
Control	5.83	5.44				5.57	4.75			
Intention			.27	.78	.04			2.58	.01	.39
Intervention	9.32	6.64				9.77	6.70			
Control	9.01	7.49				7.36	5.30			
Self-efficacy			.21	.83	.03			3.03	<.01	.35
Intervention	6.91	5.38				8.58	6.70			
Control	6.73	5.58				5.91	4.62			

To examine the intervention effects at posttest (T2), repeated measures ANOVAs were computed. For *dental flossing*, no effect of time emerged, $F(1,164) = 2.45$, $p = .11$, and no treatment effect, $F(1,164) = 2.76$, $p = .09$. However, there was an interaction between treatment and time, $F(1,164) = 4.60$, $p = .03$, $\eta^2 = .02$ (see Figure 1). Girls in the intervention group increased their dental flossing whereas girls from the control group maintained it over time. For *self-efficacy*, no effect of time emerged, $F(1,164) = .95$, $p = .33$, and no treatment effect, $F(1,164) = 3.56$, $p = .06$. Nevertheless, an interaction between treatment and time, $F(1,164) = 8.12$, $p = .005$, $\eta^2 = .04$, (see Figure 2) was found such that girls from the intervention group showed increased whereas girls from the control group decreased levels of self-efficacy at post-test.

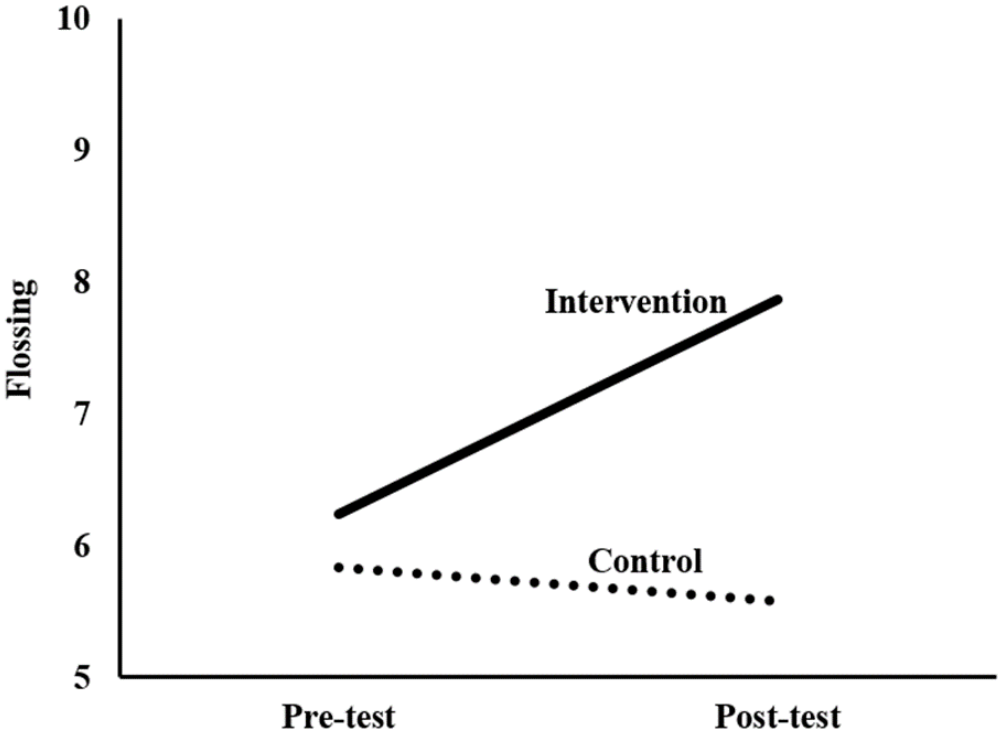


Figure 1. Levels of flossing frequency in the two experimental conditions at two points in time.

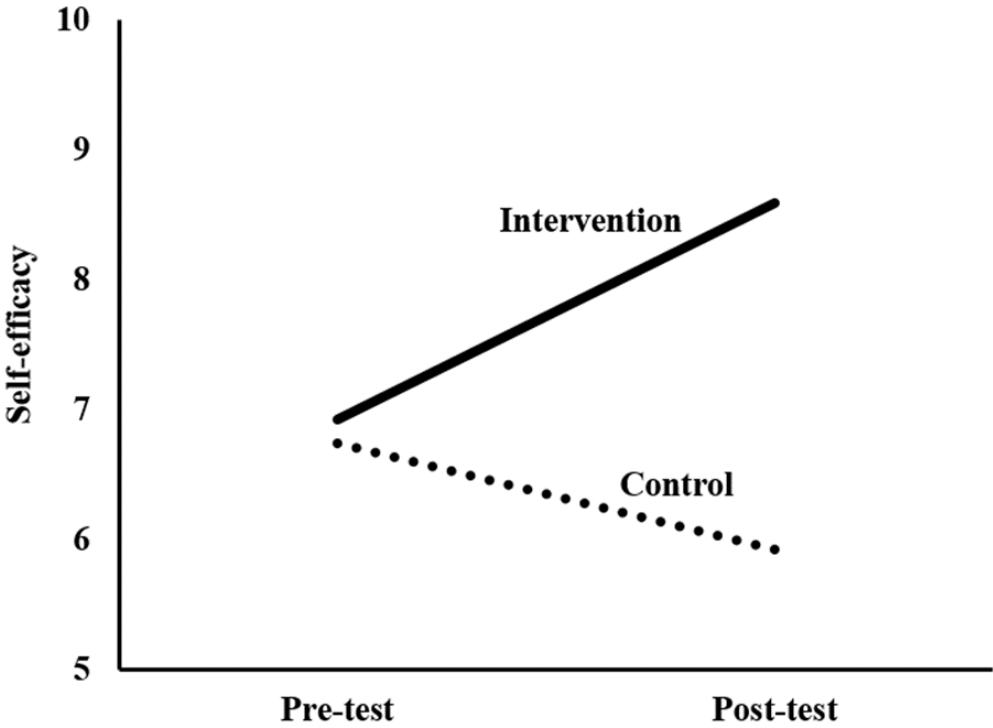


Figure 2. Levels of self-efficacy in the two experimental conditions at two points in time.

For *intention*, no effect for time emerged, $F(1,164) = 1.65$, $p = .20$, and no main effect for experimental group, $F(1,164) = 2.16$, $p = .14$. An interaction between group and time emerged, $F(1,164) = 5.06$, $p = .02$, $\eta^2 = .03$, (see Figure 3): Whereas intention levels remained unchanged in the intervention group, they decreased in the control condition.

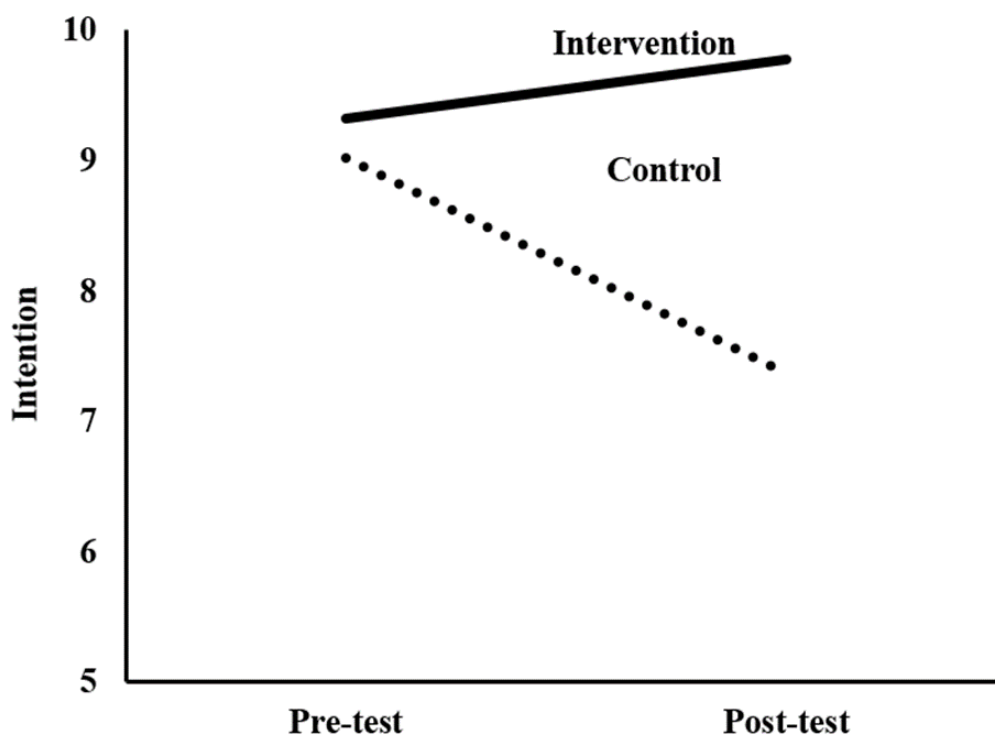


Figure 3. Levels of intention in the two experimental conditions at two points in time.

For *coping planning*, an effect of time emerged, $F(1,164) = 9.31$, $p = .003$, and also a treatment effect, $F(1,164) = 5.36$, $p = .02$, but no interaction between treatment and time, $F(1,164) = .93$, $p = .33$. Furthermore, no change in *action planning* was observed.

Mediation analysis

The following analysis addresses the question of whether the major intervention ingredients, intention and self-efficacy were instrumental in the change of dental flossing

frequency. Only intention and self-efficacy, but not the planning variables were included in the model, because action planning and coping planning did not emerge as significant predictors of dental flossing in this study. To test mediation, intention and self-efficacy (as residual change scores) were considered to serve as sequential mediators between the intervention and dental flossing. A path model, controlling for baseline behavior, yielded the expected results. There was an effect of intention on self-efficacy and also an effect of self-efficacy on dental flossing at post-test. The total indirect effect was 0.31 (95% CI[0.12, 0.54]), the indirect effect of treatment on dental flossing via intention was 0.08 (95% CI[0.007, 0.21]), and the indirect effect of treatment on dental flossing sequentially via changes in intention and self-efficacy was 0.16 (95% CI[0.05, 0.35]). Figure 4 displays the mediation model using a standardized solution.

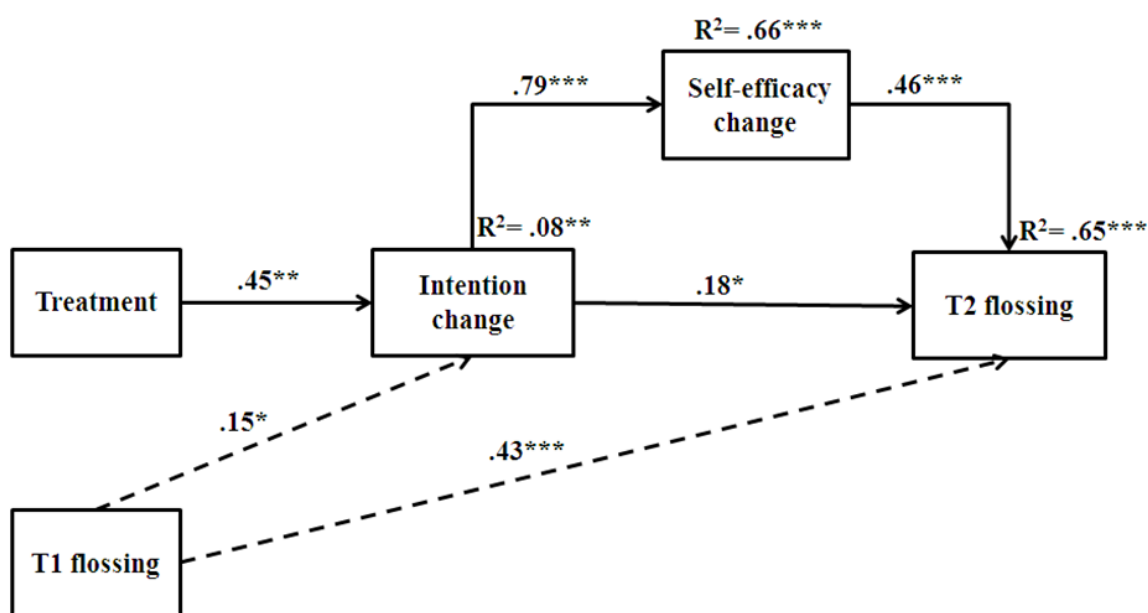


Figure 4. Effects of experimental conditions (1=treatment, 0=control) via changes in intention and self-efficacy on dental flossing, controlling for baseline dental flossing. Standardized solution; bootstrapped with 5,000 resamples. *** $p < .001$, ** $p < .01$, * $p < .05$.

Discussion

This study examined whether a brief self-regulatory intervention would make a difference in dental flossing in school-age girls. The intervention was theory-guided, inspired by the health action process approach (Schwarzer, 2008) that included self-regulatory constructs such as intention, self-efficacy, and planning. School-aged girls were randomly assigned to a psychological intervention or a control group. Repeated measures analyses comparing these two groups at pre-test and post-test yielded time by group interactions for the dependent variables: intention, self-efficacy, and dental flossing. Participants receiving the intervention increased flossing compared to participants in the control condition. An intervention effect emerged also for behavioural intention and self-efficacy, documenting a differential treatment effects for these three dependent variables.

A further question was whether the ingredients of the treatment (behavioural intention, self-efficacy, and planning) operate as mediators between the experimental conditions and dental flossing. To examine the mechanism of behaviour change we specified a path model where changes in behavioural intention, and self-efficacy served as multiple mediators between experimental conditions and later dental flossing. Changes in intention and self-efficacy operated sequentially as mediators between experimental conditions and dental flossing at Time 2.

Results indicate the mediating role of motivation as well as self-beliefs in predicting the desired health behaviour in adolescent girls, namely dental flossing. Also other studies have shown that intention and self-efficacy are predictors of dental flossing (Millar, 2011; Schüz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009). These findings are also in line with a study illustrating that stronger self-efficacy was related to increased oral health behaviours, which in turn was associated with better oral health status (Anagnostopoulos et al., 2011). In another study it was indicated that self-efficacy significantly predicted both tooth brushing and

flossing (Buglar et al., 2010). Moreover, two studies have demonstrated that increase in self-efficacy may be an important component of interventions designed for changing oral health behaviours (McCaul et al., 1988; Stewart et al., 1996). However, despite the large body of evidence that planning predicts health behaviors, neither action planning nor coping planning contributed to predicting the outcome in this way.

There are some limitations. Assessments were self-reported, and dental flossing was measured retrospectively. One could use on-going behavioral assessments such as a dental calendar where individuals can deposit the calendar in their bathroom and tick everyday they flossed their teeth (Schüz, Sniehotta, & Schwarzer, 2007). Moreover, we have assessed action planning and coping planning by single items only. This may be another reason for not detecting differential planning increases or associations with dental flossing. Thus for an assessment of action planning and coping planning as separate constructs, a more refined assessment tool would be preferable.

Nevertheless, the theory-guided intervention design may have further elucidated the mechanisms of changing oral hygiene behavior, in this case dental flossing. The findings partly replicate similar studies with different health behaviors and, thus, make a contribution to the cumulative knowledge about self-regulatory and socio-cognitive components in health behavior change. Moreover, the present study investigates intention and self-efficacy regarding dental flossing in school-aged girls. Schools remain an important setting, offering an efficient way to reach children worldwide and, through them, families and community members. Schools provide an ideal setting for promoting oral health. The school years run from childhood to adolescence when lifelong sustainable health-related beliefs, attitudes, and behaviors are being developed. Children are particularly receptive during this period and the earlier the habits are established, the longer lasts the impact (Kwan & Petersen, 2003).

Future research should include children of both sexes in order to study gender differences. Moreover, action control variables and a follow-up assessment after a few months are suggested to investigate longer-term effects of such an intervention program.

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4

A Dietary Planning Intervention Increases Fruit Consumption in Iranian Women: A Randomized Controlled Trial

5

Application of the Health Action Process Approach to Physical Activity: A Meta-Analysis

Abstract

Objectives: Social-cognitive determinants have been studied to explain and predict the adoption and maintenance of regular physical activity. This review aims to synthesize the outcomes of published studies that have investigated the 21 associations among such constructs and with physical activity on the basis of the Health Action Process Approach (HAPA).

Method: A systematic literature search has been conducted for HAPA-based articles that report associations between social-cognitive constructs and physical activity including cross-sectional, longitudinal, and experimental research designs.

Results: Among the 32 studies initially identified, 11 were included in the meta-analyses with a total sample size of 2677 participants. Their age ranged from 12 to 93 years (mean 43.91 years). The majority (63%) were women, 36.75% were patients, and countries of origin were the U.S., South Korea, Germany, and France. The summary effect sizes for all model associations, except for paths involving risk perception, were positive and significant (all $p < .001$) but they remained heterogeneous. Moderator search yielded no evidence that moderators (i.e., country, age, gender, study design, and sample type) had systematic effects on the associations.

Conclusions: Meta-analyses on the 21 paths in the HAPA resulted in high associations among social-cognitive constructs and with physical activity. To identify more homogeneous subsets of associations, another meta-analysis with a larger sample of studies is needed that allows to test a multitude of putative moderators.

Keywords: physical activity; health action process approach; meta-analyses; health behavior.

Introduction

Physical activity is essential for health and well-being, but most people find it difficult to adopt and maintain this behavior. Various social-cognitive determinants have been investigated to understand and predict engaging in regular physical activity or physical exercise. Depending on the theoretical background, those social-cognitive constructs can vary in different studies. Major constructs that are studied in relation with predicting or improving physical activity and exercise are self-efficacy (Blanchard et al., 2007; Higgins, Middleton, Winner, & Janelle, 2013; Luszczynska, Schwarzer, Lippke, & Mazurkiewicz, 2011; Parschau et al., 2013; Williams et al., 2008; Williams & French, 2011), planning (Araújo-Soares, McIntyre, & Sniehotta, 2009; Carraro & Gaudreau, 2010, 2013; Koring et al., 2012; Luszczynska, Gibbons, Piko, & Tekozel, 2004; Pakpour et al., 2011; Reuter et al., 2010; Sniehotta, Gorski, & Araújo-Soares, 2010; Sniehotta, Scholz, & Schwarzer, 2005a; Ziegelmann, Lippke, & Schwarzer, 2006), and self-regulation (Dombrowski & Luszczynska, 2009; Karoly et al., 2005; Koring et al., 2013; Matthews & Moran, 2011; Nickel & Spink, 2010; Schüz, Wurm, Warner, Wolff, & Schwarzer, 2013; Stadler, Oettingen, & Gollwitzer, 2009; Umstätt, Wilcox, Saunders, Watkins, & Dowda, 2008). Some studies employ multiple social-cognitive variables to predict the joint associations between them and physical activity, and other studies only assess the bivariate relation of one construct with the chosen behavior. Besides these, there are studies that follow a defined structure according to social-cognitive models as a rationale for choosing constructs and arranging their relationships in the process of analyzing and assessment of outcomes. However the results vary considerably even when studies use the same model or theory. The current review is designed to synthesize the outcomes of studies that have been conducted to understand the associations between social-cognitive variables and physical activity on the basis of the Health Action Process Approach (HAPA) (Schwarzer, 2008).

Health action process approach

According to the HAPA, to adhere to recommended health behaviors, one has to become motivated first, and then one needs additional self-regulatory skills and behaviors to translate the motivation into action (Schwarzer, 2008). The model suggests a distinction between (a) pre-intentional motivation processes that lead to a behavioral intention (motivational phase), and (b) post-intentional volition processes that lead to the actual health behavior (volitional phase). In the motivation phase, an individual develops an intention to act. In this phase, risk perception sets the stage for elaboration of thoughts about consequences and competencies. Outcome expectancies pertain to the perceived consequences of one's actions. Further, perceived task self-efficacy operates jointly with outcome expectancies and risk perception to form a behavioral intention.

When a person is inclined to adopt a particular health behavior, the intention has to be transformed into detailed plans on how to perform the desired action. Once an action has been initiated, it has to be maintained. This is not achieved through a single act of will, but involves self-regulatory skills and strategies. Thus, the post-intentional phase is further broken down into more proximal factors, such as *planning*, *maintenance self-efficacy*, *recovery self-efficacy*, and *action control*. Two types of planning have been introduced: action planning (when, where, and how to act) and coping planning (to identify barriers and strategies to cope with them) (Sniehotta, Schwarzer, Scholz, & Schuz, 2005b). Whereas planning is a prospective strategy, that is, behavioral plans are made before the situation is encountered, action control is a concurrent self-regulatory strategy, where the ongoing behavior is continuously evaluated with regard to a behavioral standard.

Method

Study identification

A literature search was performed in PsychINFO, PubMed, MEDLINE, and PSYCHINDEX in November, 2013. Keywords used were “physical activity, HAPA”, “exercise, HAPA”, “physical exercise, HAPA”, “PA, HAPA”, “physical activity, health action process approach”, “exercise, health action process approach”, “physical exercise, health action process approach”, and “PA, health action process approach”. The first and third authors determined the eligibility of identified studies by screening the titles, abstracts, and full texts for inclusion criteria.

Eligibility criteria

The current review considered a study for inclusion if it met the following criteria: (a) measured physical activity or physical exercise as the outcome behavior; (b) the theoretical background was based on HAPA; (c) it provided correlations among study variables; or (d) provided adequate information to calculate effect sizes, and (e) was written in English. If a study met most inclusion criteria but did not provide adequate information for effect sizes, authors of articles were contacted to obtain the information. No restrictions were placed on country, type and year of publication, and study design.

Data extraction

Data were extracted from the selected studies using a pre-defined coding form (Appendix A). Studies were described in terms of author, journal, publication year, title, country, sample size, participant characteristics (i.e., age, sex, and patient/non-patient), and study design. Selected study characteristics are summarized in Table 1.

Effect sizes (i.e., correlations) between HAPA variables and physical activity as the outcome behavior were collected, or were calculated using available information. The following study types were included: experimental interventions, longitudinal studies, and cross-sectional studies. Reported coefficients from all selected studies were recorded into a pre-defined correlation matrix with 21 cells for each pair of variables.

Table 1. *Description of Studies Included in the Meta-Analysis, by Year.*

First author and Year	Population	N	Age*	Gender (% female)	Study design
Berli (2013)	Adolescents from four Swiss schools	430	14.55 (0.98)	46.3 %	Intervention
Johnson (2012)	African Americans with HIV/AIDS, USA	110	46.1 (11.0)	52.7 %	Cross sectional
Evers (2012)	Older women in Berlin, Germany	80	73.7 (4.1)	100 %	Intervention
Evers (2012)	Older women in Berlin, Germany	191	73.6 (4.2)	100 %	Intervention
Barg (2012)	Inactive middle-aged Women in USA	175	51.97 (7.64)	100 %	Longitudinal
Fleig (2011)	Cardiac and Orthopedic patients, Germany	248	49.2 (10.0)	54.1 %	Longitudinal
Chiu (2011)	MS patients in Midwest, USA	195	47.35 (10.01)	87.2 %	Cross sectional
Caudroit (2011)	Retired older individuals, France	120	65.38 (5.63)	65.83 %	Longitudinal
Wiedemann (2009)	Cardiac Patients, Germany	12	60.3 (10.4)	18.3%	Longitudinal
Renner (2007)	Residents of Seoul and Kyungki-do, South Korea	697	32 (17.5)	51.36 %	Longitudinal
Snihotta (2005)	Patients with coronary heart disease, Germany	307	59 (9.98)	20.2 %	Longitudinal

* Values are means with standard deviation in parentheses.

Statistical procedure

For a full model of HAPA, effect sizes for 21 paths between each pair of variables were considered separately for meta-analyses (i.e., “risk perception-outcome expectancy”, “risk perception-intention”, “risk perception-action self efficacy”, “risk perception-coping self efficacy”, “risk perception-planning”, “risk perception-physical activity”, “outcome expectancy-intention”, “outcome expectancy-action self efficacy”, “outcome expectancy-coping self efficacy”, “outcome expectancy-planning”, “outcome expectancy-physical

activity”, “intention-action self efficacy”, “intention- coping self efficacy”, “intention-planning”, “intention- physical activity”, “action self efficacy- coping self efficacy”, “action self efficacy- planning”, “action self efficacy- physical activity”, “coping self efficacy-planning”, “coping self efficacy- physical activity”, and “planning- physical activity”).

A meta-analysis with 95% confidence intervals was performed using procedures for weighting by sample size as well as transformation of correlations to Fisher’s Z, for each path in each study (Borenstein, Hedges, Higgins, & Rothstein, 2011). A random-effects model was selected for the overall analyses to account for the diversity between study designs and populations. Twenty-one separate random effect models were used to assess the mean correlation for each path within the HAPA model. Q statistics were used to determine whether there is heterogeneity of summary effects, and moreover, an I squared index (Higgins & Thompson, 2002) was used to quantify the dispersion of summary effects for all 21 paths. Moderators were tested using meta-regression for continuous variables and subgroup analysis for categorical variables. All analyses were conducted by Comprehensive Meta-Analyses software version 2.0 (Borenstein et al., 2011).

Results

The described search strategy identified 32 potentially relevant articles. Of these, 16 studies were removed due to duplicate records, three records were excluded after reviewing the abstract, and an additional two were excluded after full text review, leading to 11 studies that were included in the current research synthesis (Figure 1), with six longitudinal, two cross-sectional and three intervention designs.

Description of included studies

Age of participants in the studies ranged from 12 to 93 years with a mean age of 43.91 years. The majority of participants (63%) were women. In addition, 36.75% of the participants were patients (i.e., cardiac, orthopedic, multiple sclerosis, HIV/AIDS, coronary heart disease). Moreover, 26.03% of participants were South Korean, 35.48% German, 4.48% French, and 33.99% from the US.

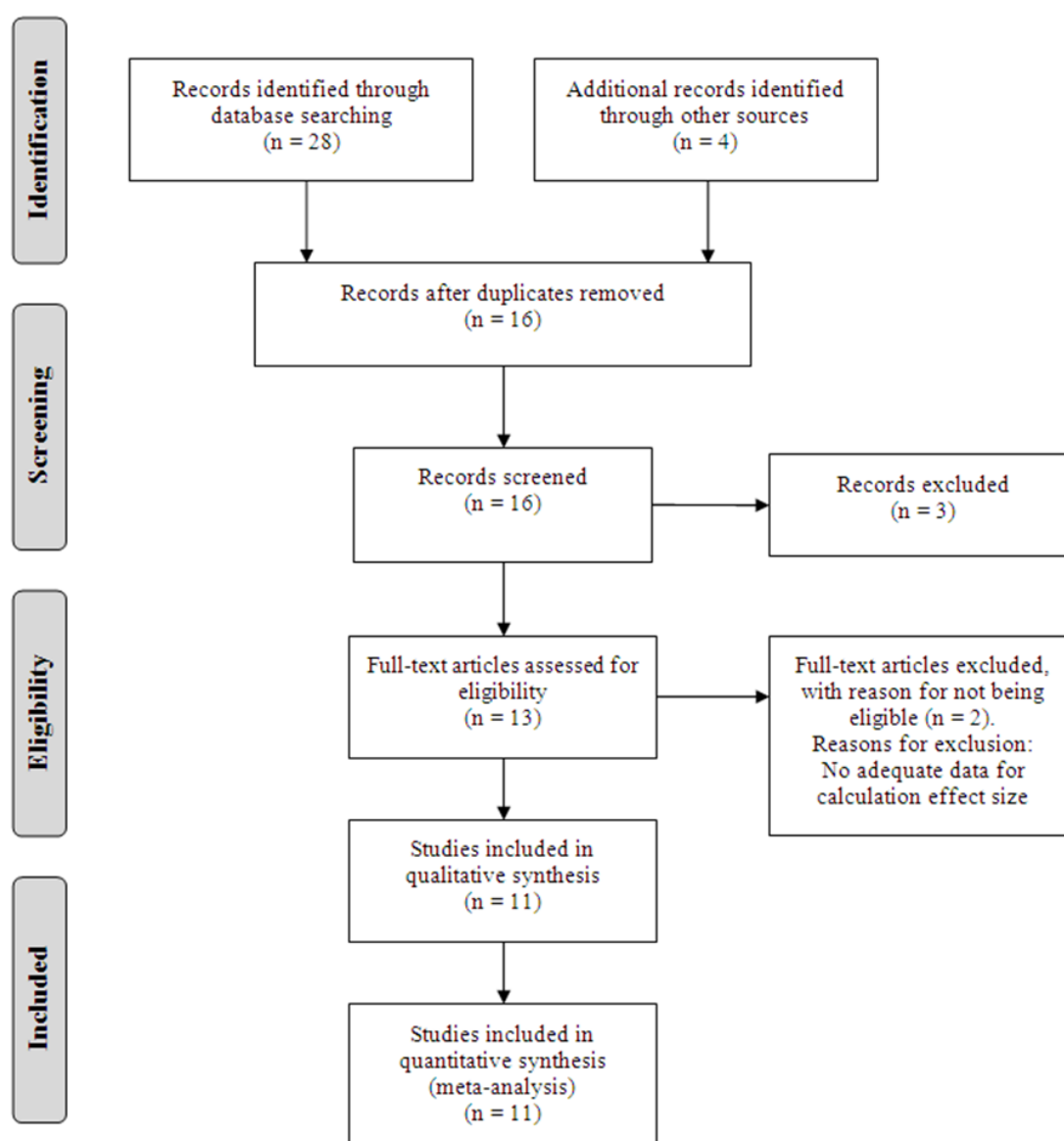


Figure 1. PRISMA (Moher, Liberati, Tetzlaff, & Altman, 2009) flowchart for study inclusion.

Summary effects

The summary effects, lower limits and upper limits, test of null hypothesis and test of heterogeneity for 21 paths are summarized in Table 2. The summary of the effect sizes for every path except for paths between risk perception and other variables were positive and significant as indicated by 95% confidence intervals. Risk perception, however, did not have a significant effect size in relation with any of the HAPA variables. Figure 2 depicts zero-order associations among all variables under study.

Tests of heterogeneity, as shown by the Q-value and the I-squared index for all paths in Table 2 revealed significant variations in the individual effect sizes indicating lack of homogeneity. In such a situation it is mandatory to search for moderator effects.

Table 2. Summary effects, lower limits and upper limits and test of null hypothesis and test of heterogeneity.

	Number of studies	Effect size and 95% interval				Test of Null (2-tail)			Heterogeneity		
		Summary effect	Lower limit	Upper limit	Fail-Safe N	Z-value	p-value	Q-value	df(Q)	p-value	I-squared
Planning-Physical Activity	11	0.34	0.24	0.43	811	6.75	0.00	67.69	10	0.00	85.22
Action self efficacy-Coping self efficacy	7	0.40	0.29	0.50	504	6.50	0.00	40.71	6	0.00	85.26
Action self efficacy-Physical Activity	8	0.26	0.19	0.33	285	6.82	0.00	21.34	7	0.00	67.21
Action self efficacy-Planning	8	0.36	0.27	0.44	591	7.21	0.00	38.04	7	0.00	81.60
Coping self efficacy- Physical Activity	7	0.32	0.20	0.42	315	5.25	0.00	36.78	6	0.00	83.68
Coping self efficacy- Planning	6	0.49	0.23	0.69	778	3.42	0.00	172.08	5	0.00	97.09
Intention- Action self efficacy	8	0.50	0.30	0.65	1131	4.66	0.00	194.14	7	0.00	96.39
Intention- Coping self efficacy	7	0.33	0.22	0.44	322	5.46	0.00	37.17	6	0.00	83.86
Intention- Physical activity	9	0.27	0.13	0.39	293	3.87	0.00	85.08	8	0.00	90.60
Intention- Planning	9	0.42	0.26	0.55	933	5.03	0.00	134.43	8	0.00	94.05
Outcome expectancy- Action self efficacy	7	0.39	0.31	0.47	611	8.45	0.00	26.19	6	0.00	77.08
Outcome expectancy- Coping self efficacy	6	0.24	0.11	0.37	130	3.43	0.00	35.38	5	0.00	85.87
Outcome expectancy- Intention	7	0.40	0.23	0.56	599	4.23	0.00	114.95	6	0.00	94.78
Outcome expectancy- Physical Activity	7	0.21	0.10	0.31	129	3.92	0.00	31.41	6	0.00	80.89
Outcome expectancy- Planning	7	0.31	0.20	0.42	325	5.14	0.00	43.57	6	0.00	86.22
Risk perception- Action self efficacy	7	0.02	-0.08	0.13	0	0.41	0.68	32.37	6	0.00	81.46
Risk perception- Coping self efficacy	6	0.12	-0.002	0.25	21	1.93	0.053	27.90	5	0.00	82.08
Risk perception- Intention	7	0.10	-0.02	0.22	14	1.63	0.10	43.91	6	0.00	86.33
Risk perception- Outcome expectancy	7	0.13	-0.03	0.30	28	1.60	0.11	83.70	6	0.00	92.83
Risk perception- Physical Activity	7	0.00	-0.11	0.11	0	0.00	0.99	35.47	6	0.00	83.08
Risk perception- Planning	7	0.09	-0.03	0.21	10	1.43	0.15	42.56	6	0.00	85.90

Moderator Search

For each path mentioned above, analyses were conducted separately for possible moderators, namely country of the studied population, age of the studied sample, percentage of women participants, study design (intervention, longitudinal, cross-sectional), and sample type (patient vs. not patient). However, there was no evidence that these selected moderators had systematic effects on associations among the HAPA variables and/or physical activity.

Publication bias

The fail-safe N calculations (see Table 2) suggested the number of studies that would be required to bring each of the summary effects to non-significance. The numbers in Table 2 show that except from the association of risk perception with other variables, the missing numbers of studies to bring the p -value of summary effects to a point of non-significance ($p > .05$) are very high, suggesting that the effect is not likely to be affected by unpublished studies. In other words: the summary effects could be considered as being consistent.

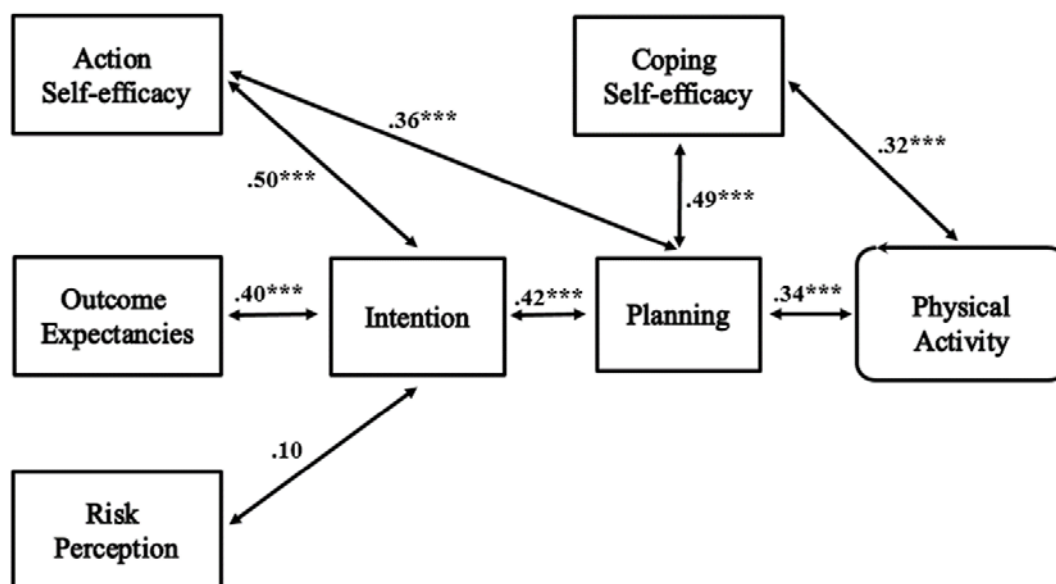


Figure 2. Health Action Process Approach (HAPA, Schwarzer, 2008)

Note: The numbers are provided for a theory based path model, for other paths please refer to Table 2;*** $p < .001$.

Discussion

The primary aim of the present meta-analysis was to quantify the pattern of associations within the health action process approach when it comes to physical activity. We also searched for special characteristics in participants and studies that further qualify relationships among HAPA variables and physical activity. Our findings show that except from risk perception, all the social-cognitive constructs of HAPA (i.e., outcome expectancies, self-efficacy, intention, planning, and action control) have significant and large effect sizes in line with theory. Studies on physical activity did not find health risk perception to be a motivating factor which points to the well-known fact that people adopt and maintain physical activity for other reasons such as well-being, social contacts, physical appearance, and weight control. This finding does not invalidate HAPA because the model is generic and was designed for various health behaviors, including also health screenings and vaccinations where risk perception appears to be more relevant. However, one can conclude that there is no indication to include risk perception in future studies on physical activity.

There are a number of meta-analyses on associations between social-cognitive constructs and physical activity. For example, Higgins et al. (2013), in their meta-analysis on 20 randomized controlled trial studies, have found that task self-efficacy had a stronger effect on the adoption of exercise, whereas coping self-efficacy is more closely related to the maintenance of exercise. Another meta-analysis by Amireault, Godin, and Vézina-Im (2013) on 31 longitudinal and experimental studies finds that those individuals who maintain regular physical activity have higher self-efficacy and intentions compared to those who relapse from the behavior. Furthermore, Carraro and Gaudreau (2013), in a meta-analysis on 23 correlational and 21 experimental studies found that action planning and coping planning partially mediated the relation between intention and physical activity. Determining the most effective single constructs is a useful starting point when it comes to design physical activity promotion

programs. However, a comprehensive framework of associations based on a theory can help to improve the quality of such applications. The novel aspect of the current meta-analysis is the contribution to understanding the relations between social-cognitive constructs and their association with physical activity on the basis of HAPA.

Strengths and limitations

To our knowledge, the current review is the first meta-analysis of studies investigating the application of HAPA to promote physical activity. This meta-analysis established that HAPA variables and physical activity have considerably high associations. The fail-safe N calculations for publication bias shows that the observed effect sizes of included studies are valid estimates of the overall summary effects of studies on HAPA and physical activity.

Limitations of the present meta-analysis involved the relatively small number of articles and the presence of heterogeneity that could not be overcome by a moderator search. We could not find any moderation effect by the characteristics of participants (i.e., age, gender, patients, and country) or study designs (longitudinal, cross-sectional, and experimental) on the paths between social-cognitive variables and physical activity, which can be due to an insufficient number of studies. Thus, heterogeneous summary effect sizes should be interpreted with the idea in mind that there must be relevant moderators that can only be detected after a larger number of studies are available.

Recommendations and future directions

More studies are needed to conduct a comprehensive meta-analysis on application of the HAPA to improve physical activity. However this review concludes that there are significant and strong associations between HAPA constructs and physical activity, which

probably remain consistent in future studies. This can provide a basis for constructing more efficient interventions for increasing target behaviors.

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6

General Discussion

General discussion

Different social-cognitive factors are associated with health behaviors. There are a number of social-cognitive theories and models that tried to describe how people engage in a set of changing behavior process (Ajzen, 1991; Bandura, 1997; Rosenstock, 1974; Schwarzer, 2008). However, the current thesis was designed to investigate the effectiveness of social-cognitive interventions and self-regulatory skills on different health behaviors (i.e., fruit and vegetable intake, physical activity and dental hygiene) on the basis of the health action process approach (HAPA; Schwarzer, 2008) within a wide range of age groups from adolescence to old adulthood among Iranian samples.

This thesis addresses two studies focusing on increasing fruit and vegetable intake among women and young children; one study focusing on increasing the incidence of dental flossing among adolescent girls; and finally a meta-analysis was designed to synthesize the outcomes of studies that have been conducted to understand the associations between social-cognitive variables and physical activity on the basis of the HAPA.

In the first study (*Chapter 2*) a self-regulation intervention for mothers was supposed to help increase vegetable consumption in their daughters. In the second study (*Chapter 3*) we have collected data from adolescents in Iran. Self-regulatory mechanisms in oral hygiene were studied by a brief intervention design to increase the frequency of dental flossing among school-aged girls. In the third study (*Chapter 4*) we examined whether a dietary planning intervention would help increase fruit consumption among Iranian women focusing on self-regulatory mechanisms in behavior change. The last study of this thesis (*Chapter 5*) was a meta-analysis review that aimed to synthesize the outcomes of published studies that have investigated the 21 associations among social-cognitive constructs and physical activity on the basis of the HAPA. A systematic literature search had been conducted for HAPA-based articles that report associations between social-cognitive constructs and physical activity. Table 1 summarizes the findings of this thesis.

Table 1. Summary of the findings in this thesis

	Findings	Conclusions
<i>Chapter 2.</i> We investigated the effect of a self-regulation intervention for mothers on the vegetable consumption of their primary school daughters. Moreover, it was expected that the intervention affects planning and self-efficacy in the experimental group.	It was found that mothers receiving the intervention reported more vegetable intake by their daughters, and the difference was substantial at Time 2. Moreover, we specified a model where Time 2 behavior served as a mediator between experimental conditions and Time 3 vegetable consumption.	Engaging mothers in self-regulatory health promotion programs may be a feasible strategy to facilitate more vegetable intake among their daughters; and thus, make a contribution to the cumulative knowledge about self-regulatory components in health behavior change.
<i>Chapter 3.</i> Self-regulatory mechanisms in oral hygiene are studied by a brief intervention design to increase the frequency of dental flossing among school-aged girls.	The brief self-regulatory intervention led to an increase in dental flossing. Changes in self-efficacy as well as in intention, but not in planning, mediated between treatment conditions and outcomes.	Self-efficacy and intention seem to play a mediating role in the mechanism that facilitates dental flossing among adolescent girls. Interventions that aim at an improvement of oral hygiene should consider use of components that combine motivation with self-confidence.
<i>Chapter 4.</i> The study examined whether a dietary planning intervention would help increase fruit consumption among Iranian women focusing on self-regulatory mechanisms in behavior change.	Findings showed that the dietary planning intervention led to an increase in fruit intake. Age moderated this mediation. Changes in dietary planning mediated between intervention and fruit consumption in women older than 30 years.	Dietary planning seems to play a role in the mechanism that facilitates fruit intake among Iranian women. This mediation by planning was found in middle aged women (30 to 48 years old), but not in young adult women (17-29 years old).
<i>Chapter 5.</i> Social-cognitive determinants have been studied to explain and predict the adoption and maintenance of regular physical activity. This review aims to synthesize the outcomes of published studies that have investigated the 21 associations among such constructs and with physical activity on the basis of the Health Action Process Approach (HAPA).	The summary effect sizes for all model associations, except for paths involving risk perception, were positive and significant (all $p < .001$) but they remained heterogeneous. A moderator search yielded no evidence that moderators (i.e., country, age, gender, study design, and sample type) had systematic effects on the associations.	Meta-analyses on the 21 paths in the HAPA resulted in high associations among social-cognitive constructs and with physical activity. To identify more homogeneous subsets of associations, another meta-analysis with a larger sample of studies is needed that allows to test a multitude of putative moderators.

Health behavior change across the life span

Chapter 2 examined whether a self-regulation intervention on mothers to feed more vegetable to their primary school-aged daughters would make a difference on vegetable consumption in these children. The mothers were randomly assigned to a self-regulation intervention or control group with a particular focus on providing a healthy nutrition. By repeated-measures analyses comparing these two groups at pretest, posttest, and follow-up, it was found that mothers receiving the intervention reported more vegetable intake by their daughters, than mothers in the control condition, and the difference was higher at Time 2, which took place two weeks after the intervention.

Furthermore to examine the mechanism of behavior change we found a model where Time 2 behavior served as a mediator between experimental conditions and Time 3 vegetable consumption in children. This finding is consistent with other studies that have shown improvements in dietary behaviors in children by targeting the parents (Tabak, Tate, Stevens, Siega-Riz, & Ward, 2012). For example, when interventions targeted parents of preschoolers as the agents of dietary change, this approach has been effective in influencing child dietary behaviors and regarding the success of weight management programs for obese children (Golan, Kaufman, & Shahar, 2006). Furthermore, experimental (Wardle et al., 2003) and observational studies (Gibson, Wardle, & Watts, 1998; Jaramillo et al., 2006) have shown that when feeding practices in parents change, children's preferences may change from sugary food items to vegetables.

One conclusion coming from these findings is that by improving health-related self-regulation skills in mothers, or the first level nutrition providers in families, the children's preference of healthy food can be improved as well. This conclusion could also be supported by Savage, Fisher, and Birch (2007), who drew on the observation that parents decide on many aspects of the home environment and found effects of parental behavior on health habits of their

children. Several studies confirm that making modifications to the home environment is effective in increasing children's vegetable intake (Brug, Tak, te Velde, Bere, & de Bourdeaudhuij, 2008; Haire-Joshu et al., 2008; Williams, Veitch, & Ball, 2011).

However, these findings show only the effect of self-regulatory interventions aiming at dietary changes in mothers which results in improving healthy diet in their children. When it comes to generalizability of the effectiveness of such interventions, then one question is whether the self-regulatory interventions are effective when we directly provide them to children themselves? In other words, should these interventions be limited to a certain age group of people, namely only adults? Another question in this regard is whether these intervention techniques are successful only for change in nutrition behaviors, or whether they can be used for other health behaviors as well? To address these questions we have conducted a study with adolescents to improve their oral hygiene behavior.

Chapter 3 examined whether a brief self-regulatory intervention would improve dental flossing in school-age girls. The intervention was theory-guided, inspired by the health action process approach (Schwarzer, 2008), and included self-regulatory constructs such as intention, self-efficacy, and planning. School-aged girls were randomly assigned to a social-cognitive intervention or a control group. Repeated measures analyses comparing these two groups at pre-test and post-test yielded that those school aged-girls who received the intervention increased flossing compared to those in the control condition.

A further question was whether the changes in the social cognitive factors that were addressed in the treatment (behavioral intention, self-efficacy, and planning) operated as mediators between the experimental conditions and dental flossing. To examine the mechanism of behavior change we specified a path model where changes in behavioral intention and self-efficacy served as multiple mediators between experimental conditions and later dental

flossing. This model showed that intentions and self-efficacy operated sequentially as mediators between experimental conditions and dental flossing at Time 2.

Results supported the mediating role of motivation as well as self-beliefs in predicting the dental flossing in adolescent girls. These findings are also supported by other studies which have shown that intention and self-efficacy are predictors of dental flossing (Millar, 2011; Schuz, Sniehotta, Mallach, Wiedemann, & Schwarzer, 2009). Moreover, Anagnostopoulos and colleagues showed that stronger self-efficacy was related to increased oral health behaviors, which in turn was associated with better oral health status (Anagnostopoulos, Buchanan, Frousiounioti, Niakas, & Potamianos, 2011). In another study it was indicated that self-efficacy significantly predicted both tooth brushing and flossing (Buglar, White, & Robinson, 2010). Moreover, two studies have demonstrated that increase in self-efficacy may be an important component of interventions designed for changing oral health behaviors (McCaul, O'Neill, & Glasgow, 1988; Stewart, Wolfe, Maeder, & Hartz, 1996).

However, despite the large body of evidence that planning predicts health behaviors, neither action planning nor coping planning contributed to predicting the outcome in this way in *Chapter 3*. One of the reasons may be that we have assessed action planning and coping planning by single items only, which may not be adequately reliable for detecting differential planning increases or associations with dental flossing. Thus, for an exact assessment of action planning and coping planning as separate constructs, a more refined assessment tool would be preferable.

To continue with the process of examining the effectiveness of self-regulatory interventions in different age groups, a healthy nutrition study in *Chapter 4* was designed to investigate whether a brief nutrition intervention can improve fruit consumption among Iranian women. Participants were randomly assigned to a psychological intervention or control group. The intervention was theory-guided based on health action process approach, with a particular

focus on dietary planning. Repeated measures yielded significant increases in fruit consumption and dietary planning. It was found that participants receiving the intervention consumed more fruit than participants in the control condition. And planning simply operated as an agent for behavior change. To examine the mechanism of behavior change we specified and confirmed a path model where changes in dietary planning served as a mediator between experimental conditions and later fruit consumption.

In a moderated mediation approach, age has turned out to serve as a moderator of the mediator-outcome path. The mediation effect of experimental conditions on fruit intake via changes in dietary planning was only valid for the middle aged women (30 to 48 years old) whereas in the young adult women (aged 17 to 29) no significant mediation took place. A very similar finding had emerged in research on physical activity changes (Reuter et al., 2010). There, planning also mediated the effect on physical activity but this was valid only for the middle aged group. Also studies using future time perspective as a moderator (Gellert, Ziegelmann, Lippke, & Schwarzer, 2012; Ziegelmann, Lippke, & Schwarzer, 2006), have found that older adults or individuals with more limited future time perspective, benefit more from self-regulation strategies in comparison with younger adults.

According to the selection, optimization, compensation model (Baltes & Baltes, 1990; Freund & Baltes, 2002; Reuter et al., 2010), the results can be interpreted as indicating a stronger planning-behavior link in middle-aged women as compared to young adult women, because these middle-aged women have more experience in terms of goal achievement which leads them to enact their plans and achieve their health goals despite barriers by increasing their effort or selecting their most important health goal. Additionally, since conscientiousness seems to be increasing during adulthood (McCrae, 2002), middle aged women may have more practice in planning and can benefit from it to a larger degree than younger women.

So far, the theory-guided intervention designs in *Chapters 2, 3, and 4* may have further elucidated the mechanisms of changing health behaviors (i.e., fruit and vegetable intake and dental flossing). The findings partly replicate similar studies with different health behaviors and, thus, make a contribution to the cumulative knowledge about self-regulatory and social-cognitive components in health behavior change.

However, when it comes to practical projects and the positive results are important, one would prefer to apply the most effective intervention according to social-cognitive models as a rationale for choosing constructs and arranging their relationships in the process of analyzing and assessment of outcomes. Thus in next study, it was investigated to what extent the HAPA model that was chosen as the main theoretical structure of the studies in this thesis, is associated with promoting physical activity, in addition to increasing fruit and vegetable consumption and dental flossing, which already have been examined and confirmed. To answer this question a meta-analysis was conducted to assess the association of HAPA variables together and with physical activity as an outcome behavior.

Chapter 5 was a meta-analysis with the primary aim to quantify the pattern of associations within the health action process approach when it comes to physical activity. Our findings show that except for risk perception, all the social-cognitive constructs of the HAPA (i.e., outcome expectancies, self-efficacy, intention, planning, and action control) have significant and large effect sizes in line with theory. Studies on physical activity did not find health risk perception to be a motivating factor which points to the well-known fact that people adopt and maintain physical activity for other reasons such as, well-being, social contacts, physical appearance, and weight control. This finding does not invalidate HAPA because the model is generic and was designed for various health behaviors, including also health screenings and vaccinations where risk perception appears to be more relevant. However, one

can conclude that there is no indication to include risk perception in future studies on physical activity.

There are a number of meta-analyses on associations between social-cognitive constructs and physical activity. For example, Higgins, Middleton, Winner, and Janelle (2013), in their meta-analysis on 20 randomized controlled trial studies, have found that task self-efficacy had a stronger effect on the adoption of exercise, whereas coping self-efficacy was more closely related to the maintenance of exercise. Another meta-analysis by Amireault, Godin, and Vézina-Im (2013) on 31 longitudinal and experimental studies found that those individuals who maintain regular physical activity have higher self-efficacy and intentions compared to those who relapse from the behavior. Furthermore, Carraro and Gaudreau (2013), in a meta-analysis on 23 correlational and 21 experimental studies found that action planning and coping planning partially mediated the relation between intention and physical activity.

Determining the most effective single constructs is a useful starting point when it comes to design physical activity promotion programs. However, a comprehensive framework of associations based on theory can help to improve the quality of such applications. The novel aspect of the current meta-analysis was the contribution to understanding the relations between social-cognitive constructs and their association with physical activity on the basis of HAPA.

Conclusion

This thesis investigated different social cognitive constructs regarding health behavior improvements, among a wide range of samples from school-age children (*Chapter 2, 3*) to adults (*Chapter 4*). The school years run from childhood to adolescence when lifelong sustainable health-related beliefs, attitudes, and behaviors are being developed. Children are particularly receptive during this period and the earlier the habits are established, the longer the impact lasts (Kwan & Petersen, 2003). Chapters 2, 3, and 4 also used rarely studied samples,

namely Iranian people. The public health education in Iran needs to be improved. Thus this thesis contributed to find the effective factors on health behavior approach among a wide range of age groups from adolescence to old adulthood.

Chapter 5, to our knowledge, is the first meta-analysis of studies investigating the application of HAPA to promote physical activity. The meta-analysis established that HAPA variables and physical activity have considerably high associations. The fail-safe N calculations for publication bias showed that the observed effect sizes of included studies are valid estimates of the overall summary effects of studies on HAPA and physical activity.

However, limitations of the meta-analysis involved the relatively small number of articles and the presence of heterogeneity that could not be overcome by a moderator search. We could not find any moderation effect by the characteristics of participants (i.e., age, gender, patients, and country) or study designs (longitudinal, cross-sectional, and experimental) on the paths between social-cognitive variables and physical activity, which can be due to an insufficient number of studies. Thus, heterogeneous summary effect sizes should be interpreted with the idea in mind that there must be relevant moderators that can only be detected after a larger number of studies are available.

Moreover, in *Chapters 2, 3, and 4* assessments were self-reported and no objective measures were available. Thus, for example in *Chapter 2* we had to rely on mothers' reports on vegetable intake of their daughters. Furthermore, all measurements in *Chapters 2-4* were retrospective. Retrospective methods are vulnerable to unintentional misreporting (e.g., due to recall errors). One could overcome this limitation by using on-going diary assessments such as family food diaries, where individuals record details of foods at the time of consumption or shortly afterwards (Kolar, 2005) or dental calendar where individuals can deposit the calendar in their bathroom and tick everyday they flossed their teeth (Schuez, Sniehotta, & Schwarzer, 2007). Nevertheless, measurement error depends on the accuracy of the reported behavior by

the participant in the same way: Individuals may forget to record target behavior, or to cover up poor health behavior habits.

Implications for future research

Future research should further examine under which circumstances other mediators may operate (e.g., self-efficacy, action control, social norms) and whether moderating effects such as age, behavior status, and intention level can be identified. This thesis showed that despite including planning in the self-regulation intervention program for adolescent girls (*Chapter 3*), the improved health behavior, namely dental flossing, was not affected by planning. Besides that, *Chapter 4* also showed that planning resulted in increased fruit intake only in those women who were over 30 years old. Accounting for the limitations of the used study materials, this may still have to do with other aspects of the investigated samples such as, cultural differences.

It has been confirmed that the social-cognitive constructs in the HAPA were associated with each other and also with physical activity to a medium to large extent, thus one recommendation for research on improving health behaviors would be to find out the most related constructs and compose them in a way that will result in a maximum change of the desired outcome. In particular, the treatment components of self-regulation interventions need to be studied systematically to identify effective ingredients and optimal dosage. Furthermore, follow-up assessments after a few months should be useful to investigate longer-term effects of intervention programs.

To conduct a comprehensive meta-analysis on the application of the HAPA to improve physical activity, more studies are needed. However, the review in *Chapter 5* concludes that there are significant and strong associations between HAPA constructs and physical activity, which may remain consistent in future studies. This can provide a basis for constructing more efficient interventions for increasing target behaviors.

The studied samples in the in *Chapters 2, 3, and 4* are female, thus one should be cautious to generalize the findings to men. However, because there is lack of such studies on males or both genders together, to make the comparison of between these two groups possible. Thus in the future, including a more representative sample of the population is recommended.

Implications for future practice

Various psycho-social factors are associated with health behavior change, which are considered as behavioral determinants, such as self-efficacy (Parschau et al., 2014; Parschau et al., 2013; Schwarzer, Antoniuk, & Gholami, 2014), planning (Fleig et al., 2013; Gholami, Lange, Luszczynska, Knoll, & Schwarzer, 2013; Godinho, Alvarez, Lima, & Schwarzer, 2013; Hagger & Luszczynska, 2013), self-regulation (Koring et al., 2013; Lange et al., 2013; Schuz, Wurm, Warner, Wolff, & Schwarzer, 2013), and action control (Godinho et al., 2013; Parschau et al., 2013; Schwarzer et al., 2014). However, when it comes to application of such constructs a specific frame of delivery of the constructs should be defined.

Theory-based intervention programs for promoting health-related behaviors help us to improve understanding of mechanisms of health behavior change. Theories are useful to explain the structural and psychological determinants of changing or promoting health behaviors. Health behavior theories focus on various determinants of behavior at different levels such as individual, interpersonal, group, organizational, and/or community (Painter, Borba, Hynes, Mays, & Glanz, 2008).

This thesis has shown for example that applying social cognitive factors based on HAPA model, resulted in promoted health behaviors such as children's vegetable intake (*Chapter 2*), dental flossing in adolescent girls (*Chapter 3*), and fruit intake in adult women (*Chapter 4*). Moreover the association of social-cognitive variables and physical activity shown in *Chapter 5* were medium to large. Thus this thesis has produced evidence that recommends application

of the HAPA in practice to improve different health behaviors.

However, when a health behavior is acquired by an individual, it needs to be internalized (Deci & Ryan, 2000; Halvari, Halvari, Bjornebekk, & Deci, 2012; Ryan & Deci, 2000). Studies suggest that internalized motivations can promote health behaviors (Halvari & Halvari, 2006; Halvari, Halvari, Bjornebekk, & Deci, 2010; Wiedemann, Gardner, Knoll, & Burkert, 2013).

The effectiveness of behavior change interventions is often restricted, that is, when the period of an intervention program ends, the engagement with the desired health behavior will end as well, and the gained behaviors are lost in the long-term (Jeffery et al., 2000). When a new action is performed, a mental link between the action and the relevant situation is created, and repetition establishes this association in memory (Wood & Neal, 2009), subsequently, when the associated situation is encountered, the behavior will be automatically activated like a habit.

The principle for habit formation is that, if a specific behavior is performed repeatedly in a certain situation, a habit will develop (Lally, van Jaarsveld, Potts, & Wardle, 2010). Habit formation is proposed to progress in four sequential stages. First, an intention must be built for behaving in a certain way. Second, the intention must be translated into action (e.g., Schwarzer, 2008). Then, the behavior must be repeated, which requires continued motivation (Rothman, 2000), and self-regulatory techniques (Michie, Abraham, Whittington, McAteer, & Gupta, 2009). In the fourth stage, the new behavior must be repeated to foster the development of automaticity (Lally & Gardner, 2013). Thus although reaching to the goal of healthy life style needs intention and self-regulation, to keep this life style in a long term, one needs to turn it to a habit.

In conclusion, the results of this dissertation are relevant for both research and practice: Using the HAPA as a theoretical backdrop for self-regulation interventions appeared to be successful. The underlying working mechanisms of health promotion programs were identified for several health behaviors, namely for fruit and vegetable intake, dental flossing, and physical activity.

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M.A 2006-2008: Azad University Tehran, Department of Clinical Psychology.

B.A 2001-2005: Shiraz University, Department of Clinical Psychology.

Academic Positions:**2008 - 2010:**

Teaching assistant, Payam Nour University, Department of Psychology, subjects:

Group Dynamics, General Psychology, Developmental psychology,
Physiologic Psychology, Psychometrics, Child Clinical Psychology,
Experimental Psychology, Learning Psychology, Psycho-Neurology.

2007/2008: Head of Research Committee at Aftab Behavior Research Center.

2007/2008: Member of publication team of Neo Psychology Science Journal.

2007/2008: Head of team for normalization of D2 Psychological test.

Research Interests:

Self-Regulation & health behavior across the life span; Healthy
nutrition & Physical activity; Longitudinal / Intervention / Survey
studies on health behavior change.

Attended workshops:

Planned missing designs, 21 May 2012, at Max Plank Institute of Human Development. Tod Little, The University of Kansas, USA.

Foundations of life span research, Summer 2012, at Max Plank Institute of Human Development. Faculty members of Max Plank Institute.

Health Psychology Across the Lifespan, Winter 2012/13, at Freie Universität Berlin. Several health psychologists from Germany and UK.

Intensive Longitudinal Methods in Health Psychology, 14 - 16 July 2013, Bordeaux (France). Dr. Gertraud Stadler (Columbia University), Prof. Jean-Philippe Laurenceau (University of Delaware), Prof. Niall Bolger (Columbia University)

Journal reviews:

Applied Psychology: Health and Wellbeing; Journal of Human Nutrition and Dietetics.

Grants & Prizes:

PHD Fellowship: International Max Plank Research School on The Life Course.

CREATE Grant for Early Career Scientists: European Health Psychology Society, CREATE, July 2013.

Best Poster Award: EHPS Conference, July 2013, Bordeaux, France.

Professional Membership:

2014-present: American Psychological association; Health Psychology Division.

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List of Publications:

(* indicates those that are part of the thesis)

- * Gholami, M., Lange, D., Luszczynska, A., Knoll, N., & Schwarzer, R. (2013). Dietary Planning Intervention Increases Fruit Consumption in Iranian Women. *Appetite*, 63, 1-6. <http://dx.doi.org/10.1016/j.appet.2012.12.005>
- Schwarzer, R., Antoniuk, A., & Gholami, M. (2014). A Brief Intervention Changing Oral Self-Care, Self-efficacy, and Self-Monitoring. *British Journal of Health Psychology*
- * Gholami, M., Wiedemann, A., Knoll, N., & Schwarzer, R. (2014). Mothers improve their daughters' vegetable intake: A randomized controlled study. *Psychology, Health & Medicine*. Advance online publication. <http://dx.doi.org/10.1080/13548506.2014.902485>
- * Gholami, M., Knoll, N., Schwarzer, R. (under review). Short self-regulatory intervention increases dental flossing in adolescents.
- * Gholami, M., Knoll, N., Schwarzer, R. (under review). Application of the Health Action Process Approach to Physical Activity: A Meta-Analysis.
- Lhaxhang, P., Gholami, M., Knoll, N., & Schwarzer, R. (under review). Comparing an Educational with a Self-Regulatory Intervention to Adopt a Dental Flossing Regimen.
- Gholami M, Aref Nazari M, & Bagheri F. (2008). Sleep Disorders, Depression, Education and Socioeconomic Status: Path Analysis. *DENA Journal of Nursing and Midwifery*, 18, 11-23.

Presentations:

Gholami, M., Lange, D., Luszczynska, A., Knoll, N., & Schwarzer, R. (2013). Dietary Planning Intervention Increases Fruit Consumption in Iranian Women. EHPS Conference, July 2013, Bordeaux, France.

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Gholami, M., Aref Nazari, M., Bagheri, F. (2009). A Bio-Psycho-Social perspective on Sleep Disorders, Depression, SES and Education. Presentation at the 9th Zagreb International Medical summit, 12-15 November 2009 in Zagreb, Croatia.

Ajdeh Far, L., Golkarian, P., Gholami, M. (2010). Effect of 30 practices in improving attention in children with ADHD. International Congress of Applied Psychology, 11-16 July 2010 in Melbourne, Australia.

Holisaz, M., Gholami, M., Nikkhu, M. (2010). Sport, General Health and Marital Satisfaction: Between Athletes and Non Athletes. International Congress of Applied Psychology, 11-16 July 2010 in Melbourne, Australia.

Ajdeh Far, L., Golkarian, P., Gholami, M. (2010). Effect of 70 practices in decreasing learning disorders in children with ADHD. International Congress of Applied Psychology, 11-16 July 2010 in Melbourne, Australia.

Gholami, M., Zolfaghari, Z. (2010). Stress Coping Style and IBS. 14th Pacific Rim College of Psychiatrists Scientific Meeting, 28-30 October 2010 in Brisbane, Australia.

Gholami, M., Filoo, A., Sanaei Zaker, B., & Jomehri, F. (2011). The effect of couple communication program on marital satisfaction. International Journal of Arts & Sciences Conference, May 30-June 3, 2011 in Vienna, Austria.

Erklärung

Hiermit versichere ich, dass ich die vorgelegte Arbeit selbständig verfasst habe. Andere als die angegebenen Hilfsmittel habe ich nicht verwendet. Die Arbeit ist in keinem früheren Promotionsverfahren angenommen oder abgelehnt worden.

Unterschrift (Maryam Gholami)

Berlin, März 2014