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Modeling Health Behavior Change: How to Predict and Modify the Adoption and Maintenance of Health Behaviors

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Abstract

Health-compromising behaviors such as physical inactivity and poor dietary habits are difficult to change. Most social-cognitive theories assume that an individual's intention to change is the best direct predictor of actual change. But people often do not behave in accordance with their intentions. This discrepancy between intention and behavior is due to several reasons. For example, unforeseen barriers could emerge, or people might give in to temptations. Therefore, intention needs to be supplemented by other, more proximal factors that might compromise or facilitate the translation of intentions into action. Some of these postintentional factors have been identified, such as perceived self-efficacy and strategic planning. They help to bridge the intention-behavior gap. The Health Action Process Approach (HAPA) suggests a distinction between (a) preintentional motivation processes that lead to a behavioral intention, and (b) postintentional volition processes that lead to the actual health behavior. In this article, seven studies are reported that examine the role of volitional mediators in the initiation and adherence to five health behaviors: physical exercise, breast self-examination, seat belt use, dietary behaviors, and dental flossing. The general aim is to examine the applicability of the HAPA and its universality by replicating it across different health behaviors, based on various measures, time spans, and samples from different countries.

Keywords: health behavior, self-efficacy, planning, adherence, intention, risk behavior

Many health conditions are caused by risk behaviors, such as problem drinking, substance use, smoking, reckless driving, overeating, or unprotected sexual intercourse. Fortunately, human beings have, in principle, control over their conduct. Health-compromising behaviors can be eliminated by self-regulatory efforts, and health-enhancing behaviors can be adopted instead, such as physical exercise, weight control, preventive nutrition, dental hygiene, condom use, or accident prevention. Health self-regulation refers to the motivational, volitional, and actional process of abandoning such health-compromising behaviors in favor of adopting and maintaining health-enhancing behaviors (Leventhal, Rabin, Leventhal, & Burns, 2001).

Health behavior change encompasses a variety of social, emotional, and cognitive factors. Some of these determinants are assumed to operate in concert. Therefore, researchers have aimed at identifying the optimal set of factors that allow for the best prediction or explanation of health behavior change. Such models or theories are subject to debate in health psychology. Which model is the most parsimonious and makes the best prediction of regular condom use, for example? From which model can we derive clinical strategies to modify refractory dietary risk behaviors? Which model suggests a good policy to promote smoking cessation at the workplace?

The currently preferred models of health behavior change overlap in terms of some of the crucial factors, but there are also major differences in terms of the underlying philosophy. This article provides a brief overview of models and the debate about their pros and cons. In particular, it examines the utility of employing one such model, the Health Action Process Approach (HAPA) that is supposed to overcome some of the limitations inherent in other models.

Continuum Models versus Stage Models of Health Behavior Change

Models of health behavior change postulate a pattern of factors that may improve motivation and would eventually lead to sustained behavior change. A distinction is made between stage models and continuum models. In continuum models, individuals are placed along a range that reflects the likelihood of action. Influential predictor variables are identified and combined in one prediction equation. The goal of an intervention is to move the individual along this route towards action. Such models assume that a person's behavior is the outcome of a conscious intention (e.g., "I intend to run four times a week for at least 30 minutes each time"). Intention forming is seen as being determined by beliefs and attitudes (Armitage & Conner, 2001; Fishbein & Ajzen, 1975). Therefore, the focus is on identifying a parsimonious set of predictors that includes constructs such as perceived barriers, social norms, disease severity, personal vulnerability, or perceived self-efficacy. These are then combined into a prediction equation for explaining behavioral intention and behavior change. The most prominent approaches of this kind are the Theory of Reasoned Action, the Theory of Planned Behavior, and Protection Motivation Theory (for an overview, see Abraham & Sheeran, 2000; Armitage & Conner, 2000; Conner, & Sparks, 2005; Schwarzer, 1992; Sutton, 1994, 1998, 2005; Weinstein, 1993, 2003, in press). A general weakness of continuum models is that they better account for intention variance than for behavior variance.

Apart from limitations at the empirical level, researchers have suggested two major theoretical deficiencies of continuum models. First, a single prediction rule for describing behavior change implies that cognitive and behavioral changes occur in a linear fashion, and that a "one-size-fits-all" intervention approach is suitable for all individuals engaging in unhealthy behaviors. Consequently, it excludes qualitative changes during the course of time, such as changing mindsets, phase transitions, or recycling back and forth. According to continuum models, it is not important whether an intervention approach is targeted first towards changing perceived vulnerability, perceived consequences, or perceived self-efficacy. Hence, interventions

are not required to be progressed in any certain sequence, but could be applied in any order, or even simultaneously. Second, continuum models typically do not account for the postintentional phase in which goals are translated into action. The segment between intentions and behaviors is a black box that is often called "intention-behavior gap" (Sheeran, 2002). However, it is quite common that people do not behave in accordance with their intentions. For example, unforeseen barriers emerge, and people give in to temptations. In a postintentional phase, various factors can compromise or facilitate the translation of intentions into action. Some of these postintentional factors have been identified, such as maintenance self-efficacy and recovery self-efficacy (Luszczynska & Schwarzer, 2003; Scholz, Sniehotta, & Schwarzer, 2005), as well as action planning and coping planning (Lippke, Ziegelmann, & Schwarzer, 2004; Luszczynska, Sobczyk, & Abraham, in press; Sniehotta, Scholz, & Schwarzer, 2005; Ziegelmann, Lippke, & Schwarzer, 2006). Theorizing about health behavior change should not be reduced to the motivation phase only, while omitting the subsequent action phase that is more decisive for behavior change. Advanced continuum models, therefore, need to include factors that help to bridge the intention-behavior gap. In doing so, it is implicitly assumed that there are at least two processes of behavior change, a motivational one that ends with an intention, and a volitional one that ends with successful performance. Thus, any extension of traditional continuum models into this direction implicitly adopts the idea of distinct processes, stages, or phases in health behavior change.

To overcome the limitations of continuum models, stage theorists have made an attempt to consider process characteristics by proposing a number of qualitative stages. The Transtheoretical Model of Behavior Change (TTM; e.g., DiClemente & Prochaska, 1982; Prochaska & DiClemente, 1983; Prochaska DiClemente, & Norcross, 1992*;* Velicer, Prochaska, & Redding, 2006), for example, has become the most popular stage model. It implies that different interventions are appropriate at different stages of health behavior change. The most common version of the TTM includes five discrete stages of health behavior change that are defined in terms of one's past behavior and future goals (precontemplation, contemplation, preparation, action, maintenance). The five stages are expected to be mutually exclusive and qualitatively different. People could make multiple attempts to progress from preaction to action stages. However, relapses could occur at any time, resulting in a spiral-like progression characterized by cycling and recycling through the behavior-change process.

In addition to the five stages of change, the TTM also includes ten processes of change, as well as the perceived pros and cons of changing, perceived self-efficacy, and temptation. These additional constructs are conceptualized as causes for the transitions between the stages, whereby it is assumed that different factors are responsible for different stage transitions.

Stage models can be seen as superior to continuum models only if empirical evidence emerges that attests to the discontinuity between stages and to the successful tailoring of interventions to subgroups of individuals who have been identified at such stages. Moreover, the critical factors that move people from one stage to another need to be identified (Armitage & Arden, 2002; Sutton, 2005).

The TTM has received a great deal of attention, since its "practicability" for interventions is very appealing. However, the TTM has also been criticized. Bandura (2000) argued that different qualitative stages necessarily imply that individuals cannot move back in the transition of stages (irreversibility), and that they cannot progress from one stage to another while passing over a third one (invariance). This requirement might be too conservative, but there are other disadvantages. Weinstein, Rothman, and Sutton (1998) and Sutton (2000, 2005) argue that the notion of stages might be flawed or circular, in that the stages are not genuinely qualitative, but

are arbitrary subdivisions of a continuous process. In particular, the proposed time frame for distinguishing between different qualitative stages is not conclusive.

Furthermore, diverse studies have referred to different time frames for operational stage definitions. For instance, Velicer, DiClemente, Prochaska, and Brandenberg (1985) defined contemplation as the time in which individuals seriously think about changing behavior within the next year, whereas Prochaska et al. (1994) defined contemplation as thinking about changing within the next six months. Why should individuals who intend to quit within the next six months (contemplators) be in a different qualitative stage of action-readiness than individuals who intend to quit within the next month (preparers)? In line with this reasoning, Kraft, Sutton, and McCreath Reynolds (1999) have demonstrated with a sample of Norwegian daily smokers that precontemplators, contemplators, and preparers were not at different qualitative stages, but rather at different points along an underlying continuum. Similarly, Courneya, Nigg, and Estabrooks (2000) reported that continuous measures of intention explained more variance in exercise behavior than the stage algorithm proposed by the TTM. Other researchers who have examined the TTM found that processes of change did not predict smoking stage movements (Herzog, Abrams, Emmons, Linnan, & Shadel, 1999), and that stage-matched and stage-mismatched interventions with young adult smokers did not yield the hypothesized results (Quinlan & McCaul, 2000). Stages of change did not predict success in weight control in adult women (Jeffery, French, & Rothman, 1999). According to these studies, the TTM has received only moderate support to date, which led Abraham, Norman, and Conner (2000) to conclude that TTM stage classifications are questionable. West (2005) has summarized this critique and has concluded that the TTM needs to be abandoned. However, more recent empirical evidence has emerged in favor of the TTM, suggesting that the notion of stages of behavior change is meaningful and has pragmatic value (Lippke, Nigg, & Maddock, in press; Lippke & Plotnikoff, 2006; Velicer et al., 2006; Velicer, Redding, Anatchkova, Fava, & Prochaska, in press; Velicer, Redding, Sun, & Prochaska, in press; Velicer, Friedman et al., in press).

The Health Action Process Approach: A Model of the Adoption and Maintenance of Health Behaviors

The traditional continuum models have been mainly criticized because of the intention-behavior gap. A model that explicitly includes postintentional factors to overcome this gap is the Health Action Process Approach (HAPA; Lippke et al., 2004; Luszczynska & Schwarzer, 2003; (Schüz, Sniehotta, Wiedemann, & Seemann, 2006; Sniehotta et al., 2005; Ziegelmann et al., 2006). The model suggests a distinction between (a) preintentional motivation processes that lead to a behavioral intention, and (b) postintentional volition processes that lead to the actual health behavior. Thus, the model constitutes an implicit stage model. Within the two phases or “stages,” different patterns of social-cognitive predictors may emerge (see Figure 1). In the initial motivation phase, a person develops an intention to act. In this phase, risk perception is seen as a distal antecedent (e.g., “I am at risk for cardiovascular disease”). Risk perception in itself is insufficient to enable a person to form an intention. Rather, it sets the stage for a contemplation process and further elaboration of thoughts about consequences and competencies. Similarly, positive outcome expectancies (e.g., “If I exercise five times per week, I will reduce my cardiovascular risk”) are chiefly seen as being important in the motivation phase, when a person balances the pros and cons of certain behavioral outcomes. Further, one needs to believe in one's capability to perform a desired action (perceived self-efficacy, e.g., “I am capable of adhering to my exercise schedule in spite of the temptation to watch TV”). Perceived self-efficacy operates in concert with positive outcome expectancies, both of which contribute substantially to forming an

intention. Both beliefs are needed for forming intentions to adopt difficult behaviors, such as regular physical exercise.

After a person develops an inclination towards a particular health behavior, the 'good intention' has to be transformed into detailed instructions 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 postintentional phase should be further broken down into more proximal factors, such as planning and recovery self-efficacy. Most social cognition models do not address explicitly postintentional factors (Luszczynska & Schwarzer, 2005). As an exception, Bandura (1997) elaborates on preintentional as well as postintentional processes in much detail, but does not depict a particular postintentional factor in a model diagram (Bandura, 2000, p. 121). In the following, two major volitional constructs, self-efficacy and planning, will be explained in more detail.

Phase-Specific Self-Efficacy Beliefs as a Volitional Factor

Perceived self-efficacy has been found to be important at all stages in the health behavior change process (Bandura, 1997), but it does not always constitute exactly the same construct. Its meaning depends on the particular situation of individuals who may be more or less advanced in the change process. The distinction between action self-efficacy, coping self-efficacy, and recovery self-efficacy has been brought up by Marlatt, Baer, and Quigley (1995) in the domain of addictive behaviors. The rationale for the distinction between several phase-specific self-efficacy beliefs is that during the course of health behavior change, different tasks have to be mastered, and that different self-efficacy beliefs are required to master these tasks successfully. For example, a person might be confident in his or her capability to be physically active in general (i.e., high action self-efficacy), but might not be very confident to resume physical activity after a setback (low recovery self-efficacy).

Action self-efficacy (also called "preaction self-efficacy") refers to the first phase of the process, in which an individual does not yet act, but develops a motivation to do so. It is an optimistic belief during the preactional phase. Individuals high in action self-efficacy imagine success, anticipate potential outcomes of diverse strategies, and are more likely to initiate a new behavior. Those with less self-efficacy imagine failure, harbor self-doubts, and tend to procrastinate. While action self-efficacy is instrumental in the motivation phase, the two following constructs are instrumental in the subsequent volition phase, and can, therefore, by summarized under the heading of "volitional self-efficacy".

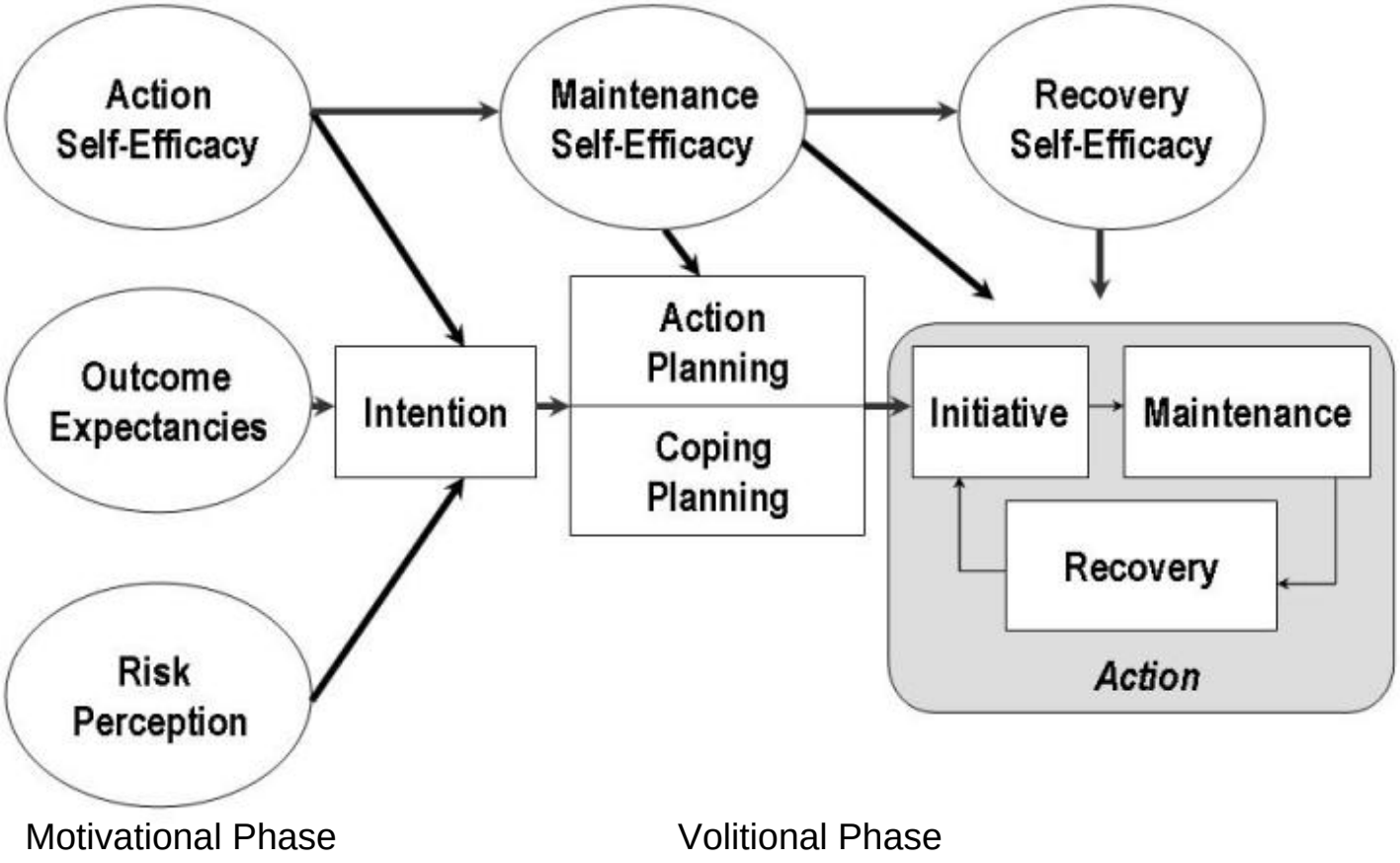

Figure 1. Generic diagram of the Health Action Process Approach.

Maintenance self-efficacy (coping self-efficacy), on the other hand, represents optimistic beliefs about one's capability to deal with barriers that arise during the maintenance period (The term "coping self-efficacy" has also been used in a different sense; therefore, we prefer the term "maintenance self-efficacy"). A new health behavior might turn out to be much more difficult to adhere to than expected, but a self-efficacious person responds confidently with better strategies, more effort, and prolonged persistence to overcome such hurdles. Once an action has been taken, individuals with high maintenance self-efficacy invest more effort and persist longer than those who are less self-efficacious.

Recovery self-efficacy addresses the experience of failure and recovery from setbacks. If a lapse occurs, individuals can fall prey to the "abstinence violation effect," that is, they attribute their lapse to internal, stable, and global causes, dramatize the event, and interpret it as a full-blown relapse (Marlatt et al., 1995). High self-efficacious individuals, however, avoid this effect by attributing the lapse to an external high-risk situation and by finding ways to control the

damage and to restore hope. Recovery self-efficacy pertains to one's conviction to get back on track after being derailed. The person trusts his/her competence to regain control after a setback or failure and to reduce harm (Marlatt, 2002).

There is a functional difference between these self-efficacy constructs, whereas their temporal sequence is less important. Different phase-specific self-efficacy beliefs may be harbored at the same point in time. The assumption is that they operate in a different manner. For example, recovery self-efficacy is most functional when it comes to resuming an interrupted chain of action, whereas action self-efficacy is most functional when facing a novel challenging demand (Luszczynska, Mazurkiewicz, Ziegelmann, & Schwarzer, 2007; Luszczynska & Sutton, 2006).

This distinction between phase-specific self-efficacy beliefs has proven useful in various domains of behavior change (see Marlatt et al., 1995). Action self-efficacy tends to predict intentions whereas maintenance self-efficacy tends to predict behaviors. Individuals who had recovered from a setback needed different self-beliefs than those who had maintained theirs levels of activity (Scholz et al., 2005). Several authors (Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002; Rodgers & Sullivan, 2001) have found evidence for phase-specific self-efficacy beliefs in the domain of exercise behavior (i.e., task self-efficacy, maintenance self-efficacy, and scheduling self-efficacy). In studies applying the HAPA, phase-specific self-efficacy differed in the effects on various preventive health behaviors, such as breast self-examination (Luszczynska & Schwarzer, 2003), dietary behaviors (Schwarzer & Renner, 2000), and physical exercise (Scholz et al., 2005).

Mental Simulation: Two Kinds of Planning as Mediators of Intentions and Behaviors

Good intentions are more likely to be translated into action when people develop success scenarios and preparatory strategies of approaching a difficult task. Mental simulation helps to identify cues for action. The terms planning and implementation intentions have been used to address this phenomenon. Research on action plans has been suggested by Leventhal, Singer, and Jones (1965), who have stated that fear appeals can facilitate health behavior change only when combined with specific instructions on when, where, and how to perform them. Renewed attention to planning had emerged when the concept of implementation intentions was introduced from the perspective of motivation psychology (Gollwitzer, 1999). Meta-analyses have summarized the findings on the effects of implementation intentions on health behaviors (for an overview, see Sheeran, Milne, Webb, & Gollwitzer, 2005). Self-reported action planning was also found to mediate the relations between intentions and physical activity among students (Conner & Norman, 2005; Norman, & Conner, 2005). Action planning is more than simply an extension of the intention because it includes specific situation parameters ("when", "where") and a sequence of action ("how"). It is more effective than intentions when it comes to the likelihood and speed of performance, partly because behavior might be elicited almost "automatically" when the relevant situational cues are encountered; people do not forget their intentions easily when specified in a when, where, and how manner (for an overview and meta-analysis, see Gollwitzer & Sheeran, 2006).

A different way of planning is the anticipation of barriers and the generation of alternative behaviors to overcome them. This has been called coping planning (Scholz, Sniehotta, Burkert, & Schwarzer, in press; Sniehotta, Scholz et al., 2005). People imagine scenarios that hinder them to perform their intended behavior, and they develop one or more plans to cope with such a challenging situation. For example: "If I plan to run on Sunday but the weather does not permit it, I will go swimming instead", or "If there is something exciting on TV tonight that I do not want

to miss, I will reschedule my workout to the afternoon". Coping planning might be a more effective self-regulatory strategy than action planning, partly because it implies action planning. After people contemplate the when, where and how of action, they imagine possible barriers and generate coping strategies. Thus, coping planning comes on top of action planning. Planning is an alterable variable. It can be easily communicated to individuals with self-regulatory deficits. Quite a few randomized controlled trials have recently documented the evidence in favor of such planning interventions (e.g., Luszczynska, 2006; Luszczynska, Tryburcy, & Schwarzer, in press).

Therefore, the general emphasis of the studies presented here lies on the assumption that action plans and/or coping plans constitute a valuable proximal construct by moving further into the volition phase, and by allowing a better prediction of behaviors (Ziegelmann & Lippke, in press).

Examples for Operational Definitions of Constructs

The constructs of the HAPA are reflected by operational definitions that have been found valid to produce the hypothesized results. These are brief psychometric scales, tailored to the particular research context, with a four-point or seven-point response format. The following are item examples (for more details see also http://www.gesundheitsrisiko.de/docs/RACKEnglish.pdf).

Risk Awareness. To assess risk awareness several options exist, that might refer to an absolute or relative health risk, addressing a specific disease or a broader illness category. One frequently used option is the following (Renner, 2003, 2004). Example:

Compared to an average person of my sex and age, my chances of getting a cardiovascular disease are …						
❑1	❑2	❑3	❑4	❑5	❑6	❑7
much below average	below average	a little below average	average	a little above average	above average	much above average

Positive outcome expectancies. A broad range of outcome expectancies can be addressed and, if desired, they can be subdivided into social, physical and emotional outcome expectancies. Moreover, negative outcome expectancies can be provided. However, we have found that positive ones are sufficient to predict intentions whereas negative ones do not further improve the amount of variance accounted for. Example:

Which will be the likely personal consequences if you quit smoking? If I quit smoking …				
	Not at all true	Barely true	Mostly true	Exactly true
… I will be more attractive for others (whiter teeth, better skin, no odor of clothes).	❑1	❑2	❑3	❑4
… I will feel better physically.	❑1	❑2	❑3	❑4
… my cholesterol level will improve.	❑1	❑2	❑3	❑4

Action Self-Efficacy. Perceived action self-efficacy refers to one's confidence in being capable to perform a difficult or novel behavior. The focus is on initiating such a behavior (run

three miles) or performing it once in a lifetime (jumping from a plane with a parachute). Example:

Various barriers make it hard to quit smoking. How certain are you that you can quit smoking? I am sure that …

	Not at all true	Barely true	Mostly true	Exactly true
… I can quit smoking for good eventually.	❑1	❑2	❑3	❑4
… I can quit smoking within the next month.	❑1	❑2	❑3	❑4
… I can quit smoking within the next 3 days.	❑1	❑2	❑3	❑4

Maintenance Self-Efficacy. Perceived maintenance self-efficacy refers to one's confidence in being capable to keep up a difficult behavior. The focus is on coping with imminent barriers (also labeled "coping self-efficacy"). Example:

Are you confident that you can resist the urge to smoke?
I am certain that I can refrain from smoking…

	Not at all true	Barely true	Mostly true	Exactly true
… even if friends or family members continue to smoke.	❑1	❑2	❑3	❑4
… even if I feel tense and restless.	❑1	❑2	❑3	❑4
… even if I am craving for a cigarette.	❑1	❑2	❑3	❑4

Recovery Self-Efficacy. Perceived recovery self-efficacy refers to one's confidence in being capable to resume a difficult behavior after an interruption. The focus is on lapses and to regain confidence after a relapse. Example:

In spite of good intentions, lapses or relapses may occur. Imagine you have resumed smoking for some time. How confident are you about quitting again? I am certain that I could quit again, …

	Not at all true	Barely true	Mostly true	Exactly true
… even after I have smoked one cigarette occasionally.	❑1	❑2	❑3	❑4
… even after I have resumed smoking for a couple of days.	❑1	❑2	❑3	❑4
… even after I have had a full-blown relapse.	❑1	❑2	❑3	❑4

Behavioral Intentions. Intentions are personal goals, either self-imposed or other-imposed. They are worded in line with the omnipresent research guided by the Theory of Reasoned Action

(Fishbein & Ajzen, 1975). Depending on the particular research question, one or more items are presented that give a specified time frame for the intended action. Example:

Which intentions do you have for the next time?

	Don't intend at all						Strongly intend
I intend to reduce the amount of cigarettes within the next month.	❑1	❑2	❑3	❑4	❑5	❑6	❑7
I intend to quit smoking within the next two weeks.	❑1	❑2	❑3	❑4	❑5	❑6	❑7

Action Planning. In non-experimental research, the level of one's planning is subjectively appraised. A typical item is the following. Example:

If you intend to quit smoking in the near future, do you have a clear idea of exactly when and how this might be materialized?
I have a detailed plan ...

	Not at all true	Barely true	Mostly true	Exactly true
… when to quit smoking.	❑1	❑2	❑3	❑4
… how to quit smoking.	❑1	❑2	❑3	❑4

Coping Planning. Coping planning pertains to the anticipation of barriers that might arise in the process of the adoption and maintenance of a behavior, and the degree to which the individual has developed appropriate strategies to cope with such barriers. Example:

Later on, after your first smoke-free day, have you thought about possible barriers that might interfere with your goals? I have a detailed plan ...

	Not at all true	Barely true	Mostly true	Exactly true
… how to respond when a friend offers me a cigarette.	❑1	❑2	❑3	❑4
… how to avoid a high risk situation where the urge to smoke might overwhelm me.	❑1	❑2	❑3	❑4
… how to arrange my daily routines to minimize temptations to smoke.	❑1	❑2	❑3	❑4

Using the HAPA as an Explicit Stage Model: Three Mindsets

Including planning and self-efficacy as volitional mediators renders the model into an implicit stage model because it implies the existence of (at least) two phases or stages, a motivational one and a volitional one. The purpose of such a model is twofold: It allows a better prediction of behavior and it reflects the assumed causal mechanism of behavior change.

Research that is based on this model, therefore, employs path-analytic methods (e.g., Lippke, Ziegelmann, & Schwarzer, 2005).

However, when it comes to the design of interventions, one can consider turning the implicit stage model into an explicit one. This is done by identifying individuals who reside either at the motivational stage or the volitional stage. Then, each group becomes the target of a specific treatment that is tailored to this group. Moreover, it is theoretically meaningful and has been found useful to subdivide further the volitional group into those who perform and those who only intend to perform. In the postintentional preactional stage, individuals are labeled "intenders," whereas in the actional stage they are labeled "actors." Thus, a suitable subdivision within the health behavior change process yields three groups: nonintenders, intenders, and actors. The term "stage" in this context was chosen to allude to the stage theories, but not in the strict definition that includes irreversibility and invariance. The terms "phase" or "mindset" may be equally suitable for this distinction. The basic idea is that individuals pass through different mindsets on their way to behavior change. Thus, interventions may be most efficient when tailored to these particular mindsets. For example, nonintenders are supposed to benefit from confrontation with outcome expectancies and some level of risk communication. They need to learn that the new behavior (e.g., becoming physically active) has positive outcomes (e.g., well-being, weight loss, fun) as opposed to the negative outcomes that accompany the current (sedentary) behavior (such as developing an illness or being unattractive). In contrast, intenders should not benefit from such a treatment because, after setting a goal, they have already moved beyond this mindset. Rather, they should benefit from planning to translate their intentions into action. Finally, actors do not need any treatment at all unless one wants to improve their relapse prevention skills. Then, they should be prepared for particular high-risk situations in which lapses are imminent. This can be done by teaching them to anticipate such situations and by acquiring the necessary levels of perceived recovery self-efficacy (Marlatt, 2002).

In the following sections, empirical evidence will be provided that attests to the validity of the HAPA for diverse health behaviors in a variety of settings. The first four applications pertain to the continuum variant, the last three refer to studies that have examined explicit stages.

Empirical Evidence: HAPA as a Continuum Model With Implicit Stages

Study I: Physical Exercise Adherence After Cardiac Rehabilitation

The following studies examined whether the overall model fit different data sets and, in particular, whether the mediator status of the two postintentional mediators, self-efficacy and planning, could be confirmed. Study I investigated exercise adherence in a sample of cardiac rehabilitation patients (Scholz et al., 2005; Sniehotta, Scholz et al., 2005). In Germany, cardiac rehabilitation is usually provided on an inpatient basis, and it consists of a comprehensive physical and psycho-educational training, including regular sessions of physical exercise on an almost daily basis. Patients learn that they need to lead an active lifestyle in order to recover completely and to prevent a recurrence of their cardiac condition. Thus, at the end of the rehabilitation period, patients can be seen as being motivated and knowledgeable. They do not need further risk communication, but rather detailed instructions on how to develop and apply self-regulatory skills. It can be expected that differences in physical activity are partly due to such volitional factors.

In the study conducted by Scholz and Sniehotta, there were 353 cardiac patients with a mean age of 59 years. The authors collected a longitudinal data set at three points in time covering a four-month period. Time 1 took place during the second week of the three-week stay

in the rehabilitation center, and Times 2 and 3 questionnaires were mailed two and four months after discharge. Risk perception, positive outcome expectancies, action self-efficacy, and behavioral intentions were assessed at the first measurement point in time, whereas planning and recovery self-efficacy were assessed at Time 2, and physical activity at Time 3.

A structural equation model designed to reflect the HAPA fit the data well. Of the physical activity variance, 14% was explained jointly by previous planning and recovery self-efficacy. More importantly, planning emerged as a mediator between intentions and behaviors, and recovery self-efficacy mediated between action self-efficacy and behavior, as hypothesized. Of the planning variance, 17% was accounted for by intention and recovery self-efficacy. Nine percent of the variance of recovery self-efficacy was accounted for by action self-efficacy, attesting to the discriminant validity of the two constructs.

This study is characterized by a unique and homogeneous population, namely cardiac inpatients at the end of their medical rehabilitation. They were in a postintentional state, which implies that there was not much variance left. Their exercise levels four months after discharge are probably mainly determined by their medical condition, their motivation, and the effects of rehabilitation treatment, not leaving much room for additional volitional factors. From this perspective, it is remarkable that the two volitional factors still have accounted for substantial variance in behavior.

Study II: Breast Self-Examination as an Example of a Detection Behavior

Breast self-examination (BSE) is recommended to detect early signs of breast cancer. Although this cannot prevent the onset of cancer, it has its merits as a *detection* behavior to allow for further medical diagnostics. Motivational or self-regulatory deficits inhibit the active implementation of regular detective behaviors in the same way as they make people reluctant to adopt and maintain *preventive* health behaviors.

A longitudinal study was launched to explore whether the HAPA would be suitable to reflect the relationships among motivational and volitional variables in such a context. Data were collected from 418 women whose risk perceptions, outcome expectancies, self-efficacy, intention to perform BSE, planning, and reported behaviors were examined at two points in time (Luszczynska & Schwarzer, 2003). A structural equation model similar to the one in Figure 1 was employed, making a distinction between action self-efficacy, maintenance self-efficacy, and recovery self-efficacy.

Action self-efficacy emerged as the best direct predictor of intention and planning. Planning, in turn, appeared to be the best direct predictor of BSE behaviors, followed by self-efficacy. When considering also indirect effects, the two volitional constructs appeared to be of equal value in predicting behavior. The results point to the influential role that self-regulatory factors play in translating goals into action.

BSE self-efficacy has also been a target of interventions (Luszczynska, 2004). By cluster randomization, women were assigned either to a control group or to a treatment group. The latter received information and viewed a video with a role model practicing BSE. Participants in the treatment group were asked to find two lumps in a silicone model of a female breast. Thus, the three ways to improve self-efficacy were implemented: persuasion, vicarious experience, and personal mastery experience (Bandura, 1997). After 13 weeks, many women who had never done this before reported their adoption of the desired behavior. Also, women with some experience reported an improvement of their skills and a higher frequency of practicing BSE. In addition to a significant difference in mean levels between experimental and control groups, the pattern of

relationships differed between groups. The HAPA variables accounted for 29% of behavior variance in the intervention group as opposed to only 15% in the control group.

The study contributes to the current debate on volitional factors that help to predict detective health behaviors. It not only underscores the explanatory value of the model, but also points to its suitability as a theoretical framework for interventions. Targeting self-efficacy and planning as treatment components helps to design BSE interventions that are theoretically founded and empirically successful.

Study III: Seat Belt Use of Adolescent Car Passengers

Adherence to using seat belts among car passengers is supposed to be high in countries where seat belt use is mandatory. However, the law often only applies to the drivers, not their passengers. Moreover, many adolescents do not care about safety and are reluctant to use belts. To examine the motivational and volitional factors that might account for such a behavior, the HAPA variables are supposed to be appropriate. A study by Luszczynska examined seat belt use in a sample of 298 students in a longitudinal research design, with three points in time covering a seven-month period. It was investigated whether the model fit the data, and whether self-efficacy and planning constitute mediators in the prediction of adherence (Schwarzer et al., in press).

The research team invited high school students from Warsaw, Poland, to take part in the study. They were 16 to 21 years old, and almost half of them were women. Intention, risk perception, outcome expectancies, and motivational self-efficacy were measured at Time 1. Among others, they were asked questions about their beliefs about (a) pros and cons of using seat belts, (b) negative consequences that could occur if they did not use seat belts, (c) perceived barriers that would hinder an initiation of regular seat belt use, and (d) perceived barriers that would prevent them from resuming regular seat belt use after failing to do so. Planning and recovery self-efficacy were measured at Time 2 (one month later). Seat belt use was reported at Time 3 (six months later).

The assumption was that intentions to use seat belts are not enough. Students need to have a clear idea, that is, a mental representation of being in a car wearing a seat belt. This is expressed by the planning items (“when, where, how”). Moreover, students should be confident to be able to resume their seat belt use after they have been negligent for a while (recovery self-efficacy).

Planning and self-efficacy emerged as mediators, as hypothesized, and 42% of the seat belt use variance was explained jointly by these two factors. Of the planning variance, 22% was accounted for by intention and recovery self-efficacy. Motivational self-efficacy accounted for only 8% of variance of the recovery self-efficacy, attesting to the discriminant validity of the two constructs. Self-regulatory skills and strategies seem to be of importance in the adoption and maintenance of apparently easy protective behaviors such as passenger seat belt use. In adult drivers, such a behavior has become a habit and does not require explicit plans and beliefs. However, in the process of developing such habits, HAPA variables might be useful to explain the mechanisms of behavior change. Other examples within this developmental category would be helmet use and tooth brushing in children, but we are not aware of any study that has used the present social-cognition model in such a context.

Study IV: Predicting Dietary Behaviors in South Koreans

The study examines the role that self-efficacy and planning play in the context of dietary behaviors, that is, eating a low-fat and high-vitamin diet (Renner et al., in press). The model includes three predictors of the intention to eat a healthy diet (action self-efficacy, outcome expectancies, health risk) and three predictors of self-reported nutrition behavior (intention,

maintenance self-efficacy, planning). The following research questions have been posed: (a) Does a structural equation model, including objective risk status, fit the Korean data? (b) Do the two proximal predictors of dietary behaviors, planning and maintenance self-efficacy, emerge as mediators? In particular, does maintenance self-efficacy mediate the effects of action self-efficacy on planning and dietary behaviors? Does planning mediate the effects of the intention on dietary behaviors? (c) Does the model fit equally well in subsamples of men and women, and can structural parameters be constrained to be equal for men and women? A longitudinal field study was designed to examine the interrelationships of these factors with dietary behaviors. In 697 South Korean men and women, health-risk status was assessed at Time 1 (cholesterol, blood pressure, and Body Mass Index) in conjunction with self-efficacy, outcome expectancies, and intentions. At Time 2, six months later, maintenance self-efficacy, planning, and dietary behaviors were measured.

A structural equation model was specified with self-reported nutrition as the endogenous latent variable, intention, planning, and maintenance self-efficacy as mediators, and risk status, outcome expectancies, and action self-efficacy as exogenous variables. Self-efficacy was of equal predictive power in men and women, whereas intentions and planning were relevant only in women. Objective risk status was associated with intentions in women, but not in men. The present findings contribute to our understanding of some mechanisms that are involved in health behavior change. The model might be universal, and it might be useful in describing the motivation to eat a healthy diet also in non-Western cultures. Previous studies in Europe had already confirmed that the model fits various data sets on dietary behaviors (Schwarzer & Renner, 2000; Schwarzer et al., in press).

Empirical Evidence: HAPA as an Explicit Stage Model

Study V: Stage Progression in Individuals Practicing Dental Hygiene

The following three studies were chosen as examples to characterize a more explicit stage nature of the model. As mentioned above, the Health Action Process Approach distinguishes between persons who have not yet decided to change their behavior (non-intenders in the predecisional or motivational stage) and those who have decided to change (postdecisional – inactive) or who have already implemented the changes and perform the target behavior (postdecisional – active). Thus, the volitional persons can be subdivided into intenders and actors. The motivational process culminates in the formation of intentions, and afterwards a person's focus and mindset shifts from motivation to initiation and maintenance of the behavior. Here, volitional processes, such as planning and action control, help translate intentions into action. Study V has addressed the distinction between the three mindsets (e.g., nonintenders, intenders, actors) for the adoption and maintenance of dental flossing (Schüz, Sniehotta, Mallach, Wiedemann, & Schwarzer, submitted). The assumption is that the mean values of social-cognitive variables as well as behavior differ between the subgroups. Behavioral stage was assessed in dental patients along with a questionnaire, a sample of dental floss, and cleaning instructions. Follow-up questionnaires were sent four weeks later yielding a longitudinal sample of 288 patients. Risk perception, outcome expectations, action planning, coping planning, maintenance self-efficacy, intention to floss on a daily basis, and interdental hygiene behavior were assessed. These variables were hypothesized to discriminate between *preintentional*, *intentional* and *actional* participants at Times 1 and 2. Discriminant analysis confirmed that social-cognitive variables correctly classified participants into three stages of behavior change. Moreover, they predicted forward and backward stage movement. For participants in the

preintentional stage at Time 1, stage progression could be predicted by action planning. Among intenders at Time 1, maintenance self-efficacy and coping planning discriminated regressing from static and from progressing participants. Results confirmed the assumption that progressing through stages is associated with different levels of social-cognitive variables. Those individuals who move from motivation to volition do this in conjunction with planning activities. Those who become active are the ones with higher volitional self-efficacy (Schüz, Sniehotta & Schwarzer, in press).

Study VI: Dietary Behavior: Nonintenders and Intenders are Differently Motivated to Eat Healthy Foods

A study by Renner and Schwarzer (2005) deals with the role that intentions, risk perception, outcome expectancies, and self-efficacy beliefs play when it comes to adopting or maintaining a healthy diet. The question was whether preintentional individuals differ from postintentional ones in terms of the HAPA variables. A sample of 1,782 men and women between 14 and 87 years of age provided the data. Extending a previous study (Schwarzer & Renner, 2000), this one examined the intention not only as a continuous variable, but also as a categorical variable.

The distinction between nonintenders and intenders, although simple, sheds some light on the relationships among the chosen variables. It does not come as a surprise that nonintenders report, on average, lower levels of healthy nutrition than intenders, as reflected by mean differences in the consumption of fat, fiber, vitamins, fruits, cholesterol, and an overall balanced, low-calorie diet. More interestingly, however, nonintenders have also lower mean scores of risk perception, outcome expectancies, and perceived nutrition self-efficacy, which underscores that they have progressed less through the change process. Moreover, within the group of nonintenders, healthy nutrition is well-explained by outcome expectancies, followed by self-efficacy, but not at all by risk perception. Thus, nonintenders who reported a comparably healthy diet seem not to feel very much at risk for heart disease, and, if so, this is not at all related to their nutrition style. Thus, they might eat less fat and more fiber predominantly in order to control their weight, feel more attractive, and feel mentally better.

Within the group of intenders, the variations in nutrition behaviors are somewhat less well-accounted for by the social-cognitive predictors, but are still considerable. More importantly, intenders exhibited in comparison to nonintenders a different pattern of association strength with respect to the social-cognitive variables. In the preintentional stage, outcome expectancies are more salient, whereas, in the postintentional stage, self-efficacy is more salient. Thus, by specifying intention as a moderator, it turned out that nonintenders and intenders were different in terms of the psychological mechanisms that made them eat healthy foods.

Study VII: Physical Activity: Differences at Three Stages of Change

The previous two studies have made a distinction between the motivational and the volitional stages and have compared individuals residing in those stages in terms of a variety of social-cognitive factors. Postintentional persons can be subdivided into those who have not yet acted and those who have done so. This is theoretically meaningful because they face different tasks: Postintentional inactive persons need to translate their intentions into action (Gollwitzer, 1999), whereas those who are postintentional-active need to prevent a relapse (Marlatt, 2002). Such a three-stage distinction was made in line with the HAPA, suggesting a moderator effect of stages, that is, between-stage differences in motivational mechanisms should emerge. Nonintenders, intenders, and actors were examined in terms of their physical activity (Lippke et

al., 2005). The purpose was to explore indicators of discontinuity, that is, searching for qualitative differences among groups of individuals who reside in different stages. It was hypothesized that intention formation, action planning, and behavior change were at different levels in these three stages, and that these levels were differentially predicted by self-efficacy, outcome expectancies, and risk awareness. To examine the discontinuity hypothesis, 423 orthopedic outpatients were assessed at the beginning and at the end of their rehabilitation as well as at six-month follow-up.

In a three-group structural equation model in line with Figure 1, discontinuity patterns emerged. Differences between the three stages in terms of latent means, interrelations of social-cognitive predictors, and explained variance were found. While self-efficacy was imperative within all groups of patients, risk awareness was important only for nonintenders. The intentional and the actional stages of behavior change were similar in terms of planning. The findings provided support for the usefulness of the three-stage distinction, and the stage-specific prediction of behavior change.

In a related study (Lippke et al., 2004), it was examined whether interventions were beneficial for rehabilitation patients at particular stages within the health-behavior change process. A challenging research question is whether such interventions can be tailored to the special needs of patients at different stages. In particular, this study questioned whether action planning is beneficial for those patients who have the intention to exercise, but do not perform physical activities at the recommended levels. In a longitudinal four-wave study with 560 rehabilitation patients, a planning intervention was evaluated. Patients who had been inactive so far but had the intention to exercise (intenders) particularly benefited from the planning intervention, whereas patients without the intention (nonintenders) or patients who were being active already (actors) did not benefit as much. Moreover, if patients formed intentions as well as action plans, they were more likely to adhere to the recommended level of exercise than those who where intenders, but did not make a detailed plan. The maintenance of gains for a year after the brief planning treatment is unusual in the absence of booster sessions. This suggests that self-maintaining factors are embedded in the treatment. The results confirm the assumption that matching treatments to individuals who reside in a particular stage can be a promising procedure. Further research should examine a match-mismatch design that includes tailored treatments for all three mindsets.

Discussion

The seven empirical examples from recent research projects detailed here were chosen to illustrate the broad range of applications of the HAPA. It has been shown that the model is in line with data from various cultures and diverse samples, such as old and young men and women, students, and rehabilitation patients. Five health behaviors were chosen as examples: physical exercise, breast self-examination, seat-belt use, dietary behaviors, and dental flossing. In all cases, evidence suggested that the approach was successful without giving up the principle of parsimony. The main addition of the HAPA to previous models lies in the inclusion of two volitional factors: volitional self-efficacy (either maintenance or recovery self-efficacy) and strategic planning (either action or coping planning). The purpose of these additions was to overcome the black-box nature of the intention-behavior relationship. Identifying such volitional mediators helps to elucidate the mechanisms that come into play after people have formed an intention to change their health-compromising behaviors.

By dividing the health behavior change process into a motivational and a volitional phase, the gap between continuum models and stage models is bridged. The HAPA constitutes a hybrid model in the sense that one can apply it either as the one or the other. As a continuum model, it

includes two mediators between intention and behavior. Because having formed an intention reflects a different mindset than having not done so, we regard the HAPA as an implicit stage model. The term stage is not meant in a biological sense. We use it synonymously with phase or mindset. People can cycle and recycle in this process. A further question is whether we should judge the quality and usefulness of a model only in terms of explained behavioral variance. Gaining insight into mediating processes upgrades the importance of such mediators as secondary outcomes. The mediators are relevant criteria by themselves. Even if we cannot immediately change a certain refractory behavior, we might move a crucial step further by changing one of the proximal mediators into the right direction. Elucidating the mechanisms of change is not only of pure scientific interest, but may also have policy implications.

When identifying individuals with different mindsets and separating them for particular analyses or treatments, we are dealing with a stage model. Thus, we can turn the implicit stage model into an explicit one by addressing subsets of participants. By this we go beyond the quest for mediating factors. Stage is supposed to operate as a moderator with two or more levels (e.g., nonintenders, intenders, actors). The assumption is that the mean values of social-cognitive variables and behavior differ between these subgroups. Moreover, the mediating mechanism may differ as well. Technically, the analysis reflects a moderated mediation (Lippke et al., in press). How exactly individuals with different mindsets differ in terms of the causal mechanisms of health behavior change remains a research agenda for the future. Evidence in favor of moderated mediation would support the discontinuity hypothesis, which means that change does not reflect a continuum, but rather a process that involves two or more qualitative stages (mindsets). This notion of discontinuity has been demonstrated in a number of recent contributions (Armitage, Povey, & Arden, 2003; Lippke et al., in press; Sniehotta, Luszczynska, Scholz, & Lippke, 2005; Velicer et al., 2006).

A better way of demonstrating the usefulness of a stage distinction is documented by experimental effects when manipulating one or more of the proposed mediators. Improving self-efficacy in women who were motivated to practice breast self-examination has resulted in higher levels of this behavior (Luszczynska, 2004). Improving action planning and coping planning in patients motivated to increase their physical activity, has also been successful (Luszczynska, 2006; Sniehotta, Scholz, & Schwarzer, 2006; Ziegelmann, Lippke & Schwarzer, 2006). If a proposed mediator is effective at a particular stage but not at the other, then we need to identify which individuals reside at which stage and tailor the treatment (e.g., planning, self-efficacy interventions) to one group.

In two other studies we have added the construct of action control to the model (Schüz et al., in press; Sniehotta, Nagy, Scholz, & Schwarzer, 2006). While 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. A study on dental flossing (Schüz et al., in press) has investigated stage-specific effects of an action control treatment (a dental flossing calendar). The intervention led to higher action control levels at follow-up, thus indicating volitional effects. However, the action control intervention did not improve intention formation, and, thus, had no motivational effect, as hypothesized. Action control facilitated flossing behavior in volitional individuals only. In other words, a beneficial effect emerged only in the stage-matched condition. This result is in line with the HAPA, as it suggests that only intenders benefit from self-regulatory efforts. A very parsimonious intervention, such as the provision of dental calendars for self-monitoring, may bring forth notable effects if correctly addressed to individuals who are in the volitional stage. From the perspective of modeling health behavior change, the question arises how many and

which volitional factors should be included to bridge the intention-behavior gap. After the inclusion of planning and volitional self-efficacy, action control would be a third promising candidate for a model that serves this purpose. Future research needs to find out to which degree an accumulation of further volitional factors would account for substantial variance of health behaviors or whether this would rather violate the postulate of parsimony.

Goal setting, intention formation, effort investment, planning, action control, and disengagement are self-regulatory constructs. Health self-regulation encompasses a broad range of cognitions and behaviors. Further studies could benefit from work in other fields, for example from relapse prevention theory (Marlatt, 2002; Marlatt et al., 1995) and self-regulation theories (Baumeister & Vohs, 2004; Carver & Scheier, 1998; Cervone, Shadel, Smith, & Fiori, 2006; Karoly, 1993; Kuhl, 2001; Leventhal & Mora, 2005; Locke & Latham, 1990; Maes & Karoly, 2005).

Self-regulatory constructs other than self-efficacy might help to further explain postintentional processes of health behavior change. Theories of volition emphasize that self-regulation refers to an individual's ability to focus attention on the task at hand and to keep a favorable emotional balance. Self-competencies that refer to regulation of attentional and emotional components of goal-directed behavior might play a crucial role across all phases of health behavior change. In different stages of goal pursuit, people need to pay attention and stay with the task at hand. They need to concentrate even when an interfering task emerges. Moreover, controlling interfering emotions such as boredom, anger, distress, exhaustion, anxiety, or reluctance requires a number of cognitive skills. Self-regulation of attention and emotion might also be seen as a stable personal disposition, an individual difference characteristic that enables habitual control over recurrent actions, as well as in the process of behavior change (see Cervone et al., 2006; Kazén & Kuhl, 2005; Kuhl, 2001; Luszczynska, Diehl, Gutiérrez-Doña, Kuusinen, & Schwarzer, 2004).

In the past decades, the mechanisms of health self-regulation were mainly reflected by social-cognitive prediction models. These models are being challenged by others that imply a cycling and recycling of individuals across two or more stages. This advance in the field has led to some difficulties and controversies. One refers to the demand for parsimony because variables become easily inflated. For example, the Transtheoretical Model includes five stages, ten processes, pros and cons, self-efficacy, and temptations. According to our present view, it is suggested to limit the motivation stage to only three predictors, and the self-regulation stage to two mediators. Stage progression, planning, and self-beliefs appear to be the most parsimonious set of volitional components.

The present overview, covering seven empirical studies, has demonstrated the universal applicability of the HAPA for a number of health behaviors and for diverse samples from various cultures. The finding that a structural equation model fits the data, however, does not prove that the chosen model is the only one or the best one that fits. The question is whether this model appears to be empirically superior to alternative models. Finding the best model for a particular research context requires consideration of several questions: Which model accounts for most of the criterion variance? Which one provides the best insight into the causal mechanism of health behavior change? Is the model that makes the best prediction also the best one for the design of interventions? Which is the most parsimonious one?

To test the validity of a model in comparison with other theories of health behavior change, experimental studies are required (Weinstein, Lyon, Sandman, & Cuite, 1998). So far, most of the studies that aim at comparing determinants from different theories are mainly correlational ones. A minority includes experimental manipulations and examines the

maintenance of behavior change by means of follow-up assessment. Future research should include the manipulation of constructs from this theory in one sample, and manipulation of the constructs from a different theory (such as TPB) in another sample. For example, at the stage of intention development, one group could be treated by improving positive attitudes and subjective norms (TPB), whereas the other group could be treated by improving self-efficacy, outcome expectancies, and risk perception (HAPA). At the stage of goal pursuit, on the other hand, one group could be treated by improving perceived behavioral control (TPB), whereas the other could be treated by enhancing a combination of self-efficacy, action planning, and relapse prevention (HAPA). It is unlikely that one will ever find an acid test to compare all models with each other since they are partly incompatible, as are, for example, stage models versus continuum models. Researchers tend to prefer eclectic approaches, such as selecting attractive elements from one model and implanting them into another one, which can also be seen as a means of theory evolution.

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