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Evidence for three stages of change: Predicting transitions from the prein- tention, intention and action stages

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Abstract

Stage theories of health behavior change assume that individuals pass through qualitatively different stages on their way to the adoption of health behavior. Three superordinate stages (preintention, intention, and action) can be defined by stage transitions common to all stage theories and which are supported by evidence. The present study examines whether transitions between these stages can be predicted by social-cognitive variables derived from prevailing health behavior theories. Motivation for interdental hygiene and oral self-care behaviors were assessed in 288 participants recruited in dental practices at two points in time. Stage progression and regression over time were analyzed using discriminant function analysis. Progression from preintention to intention was predicted by action planning, whereas progression and regression from intention was predicted by coping planning and maintenance self-efficacy. Results support the distinction of three superordinate stages. Findings are discussed in terms of their contribution to health behavior theory.

Key words

Stage theories, if-then planning, self-efficacy, oral self-care, stage transitions

4.1. Introduction

4.1.1. Stage theories and stage transitions

In recent years, stage theories of health behavior change have received increasing attention in research and health promotion. The idea of people passing through an ordered set of qualitatively different stages [1] on their course to decide on, initiate and maintain health-related behaviors is both intuitive and appealing for the design of interventions [2]. This process is thought to resemble a spiral pattern, with the possibility of progressing to further or regressing to previous stages [3]. The idea of qualitative differences between the stages implies that people face different barriers for progression towards behavior change at different stages, and that different variables determine these transitions. If these qualitative differences were confirmed, behavior-change interventions could be tailored to stages in order to support individuals to master stage-specific barriers and move towards the next stage. This feature constitutes the main difference to social-cognitive theories such as the Theory of Planned Behavior (TPB; [4]) which construe health behavior change as a continuous process and assume that the theory's factors are relevant for all individuals.

Stage transitions correspond with shifts in perception and cognition, because different information is relevant at different points of the change process [5]. The main dependent variable in stage theories therefore are these qualitative shifts (stage transitions) rather than behavior [1]. Thus, it is of crucial interest to identify the critical thresholds in the change process and factors that promote progression and regression between stages of change.

Current stage theories such as the Transtheoretical Model (TTM; [3]), the Precaution Adoption Process Model (PAPM; [6]), the Health Action Process Approach (HAPA; [7, 8]) or the model of action phases (MAP; [5]) differ in terms of number and definition of stages as well as the processes proposed to facilitate stage transition at each stage.

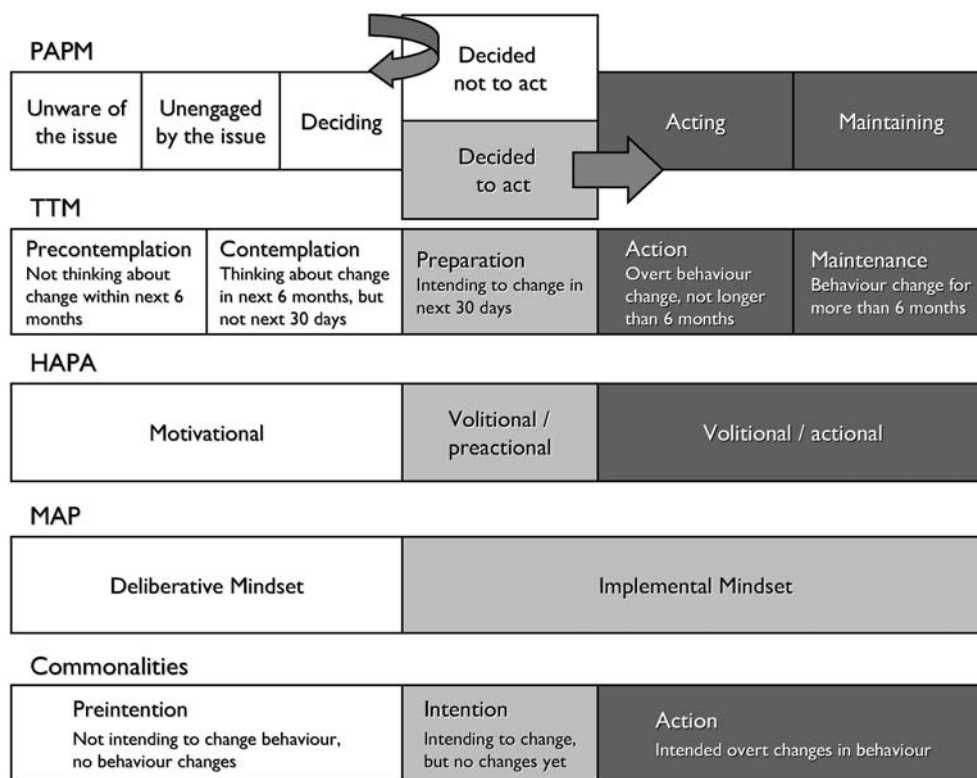
Most conclusive evidence in terms of randomized trials and systematic reviews is available for the TTM. This evidence does not support the TTM [9-14]. Evidence for other stage models is less conclusive, but some studies show promising findings and support these models by evidence [8, 15, 16].

4.1.2. Three stages of behavior change

In order to pool the existing evidence for stage assumptions, it is helpful to identify commonalities between the theories. In particular, commonalities in numbers and definitions of critical transitions in the behavior change process need to be identified in order to confirm basic as-

assumptions of stage theories [17]. Regarding these commonalities, all models define stage transitions from pre-intention to intention and from intention to action, thus constituting three critical superordinate stages that can serve as shared denominator of current stage theories [1, 18]:

1. a *preintention* stage, in which persons are not fully informed about health behavior and its consequences and have not yet decided to act (precontemplation and contemplation stage in the TTM; unaware, unengaged and deciding stages of the PAPM; motivational stage in the HAPA; deliberative mindset in the MAP)
2. an *intention* stage, in which people have decided to engage in behavior but have not yet started to act (preparation stage in the TTM; decided to act stage in the PAPM; volitional-preactional stage in the HAPA; implemental mindset in the MAP)
3. an *action* stage, in which individuals act according to their behavioral intentions (action and maintenance stages in the TTM and PAPM; volitional-actional stage in the HAPA; implemental mindset in the MAP).



Note. PAPM = Precaution Adoption Process Model; TTM = Transtheoretical Model of Behavior Change; HAPA = Health Action Process Approach; MAP = Model of Action Phases

Figure 4.1. Commonalities of current stage theories

The evidence for these three superordinate stages is stronger than for other stage distinctions:

While social-cognitive theories have provided strong evidence that forming intentions to act is facilitated by the expected outcomes of a new behavior and the confidence in one's ability to perform it (i.e., self-efficacy; [19-21]), there is evidence that these variables do not fully explain the adoption of behavior. This phenomenon has been referred to as the intention-behavior gap [22] and indicates qualitative differences between individuals who have decided to change behavior but do not yet act (intention stage) and those who already act on their intentions (action stage). This differentiation is further qualified by overt changes in behavior: While individuals in the intention stage intend to act, but do not act yet, individuals in the action stage have already changed behavior. Changes in cognitions also support differences between intenders and actors: For example, Scholz et al [23] found that self-efficacy to maintain behavior in the face of barriers predicted maintenance in individuals who previously initiated behavior, but was not predictive in those who did not.

Other processes have been shown to facilitate the uptake of intended behavior, for example if-then plans (implementation intentions or action plans; [24-26]). It has been shown that planning is most effective in individuals who have already formed goal intentions to act [27, 28]. This differential effectiveness implies qualitative differences between individuals who have not yet decided to change behavior and those who are already decided [15].

4.1.3. Predictors of stage transitions

The identification of stage-specific predictors of stage transitions in a longitudinal setting can provide evidence for qualitatively different barriers for stage progression in each stage [1, 29]. Stage transitions are the key dependent variable of stage theories and indicate successful progress towards behavior change. In order to identify factors relevant for transitions between the *preintention*, *intention* and *action* stage, it is necessary to scrutinize evidenced social-cognitive theories that explain the formation of intention and the initiation of behavior [17, 30]: If, for example, factor x is considered relevant for the prediction of intentions in theory A, and factor y is considered relevant in theory B, it would make sense to consider both factors when looking for predictors of intentions (if empirical evidence speaks in favor of both). On the other hand, if theory C assumes factor z relevant for the prediction of intentions, and theory D assumes a similar (but differently named) factor z_1 , it is necessary to look for commonalities between z and z_1 , and it would not make sense to include both, for both conceptual and statistical reasons.

Thus, in searching for factors that predict stage transitions, this study takes factors from various theories of health behavior and their similarities into consideration.

Transitions from the preintention stage

Weinstein [21] and Maddux [20] point out that there are strong conceptual and structural overlaps between the prevalent social-cognitive theories. All of these theories focus on intentions as proximal predictor of behavior and specify factors predicting intentions. Although named differently, these factors refer to similar processes: The theories agree that positive expectations about behavioral outcomes (outcome expectations), positive evaluations of personal control over behavior (self-efficacy) and personal relevance of behavior due to susceptibility (risk perception) are relevant factors for the formation of behavioral intentions. Several meta-analyses on basis of social-cognitive theories [31-33] show that there is strong evidence to support the role of these factors in intention formation.

These factors can therefore be considered potential predictors of progression from the preintention to the intention stage.

Transitions from the intention stage

Progression from the intention stage means initiating intended behavior. As outlined above, if-then planning processes play an important role in prompting behavior initiation. In this context, it is important to distinguish between experimentally induced if-then plans (*implementation intentions*, or *action plans / coping plans*) and individual levels of planning, as assessed with psychometric scales (e.g., [34-37]), as only the latter will be considered in this study. A meta-analysis [38] found effect sizes of .70 in studies correlating planning measures with goal attainment. This suggests that if-then planning processes (*action planning*) are a crucial facilitator of translating goal intentions into actual behavior.

Self-efficacy represents another relevant factor for the initiation of action [3, 23, 35, 39] as it affects not only goal setting but also goal pursuit [40].

Transitions from the action stage

There is also evidence that if-then planning can prevent from action lapses once behavior has been initiated [26, 34, 38, 41]. *Coping planning* (if-then planning for maintaining behavior in the face of barriers and difficulties) thus constitutes a potentially relevant factor preventing regression to the intention stage.

Similarly, self-efficacy with regard to dealing with barriers that arise during the maintenance period (*maintenance self-efficacy*) is a crucial resource for maintaining behavior changes and preventing relapses and stage regression [23, 35, 42, 43].

4.1.4. Present study: Oral self-care

The present study aims at identifying the determinants of stage transitions with regard to oral self-care behavior (interdental hygiene). Interdental hygiene provides an excellent means for the analysis of behavior change processes, as actual prevalence is very low [44] although daily application is highly recommended for effective caries and periodontal disease prevention by major Dental Associations [45, 46]. Even in higher educated populations such as university students, as few as 5.1% [47] or 11.5% [37] floss on a daily basis. Thus, stage transitions may be expected and set in relation with hypothesized change predictors.

4.1.5. Research aims

The present study does not seek to confirm or reject one specific stage theory. It rather aims at providing evidence for the common assumptions from current stage and social-cognitive health behavior theories regarding stage definitions and predictors of stage transitions. Identifying stage-specific predictors of longitudinal stage transitions constitutes strong evidence for qualitative differences between stages [1] and provides implications for interventions promoting stage transitions.

The main hypotheses of the study are outlined in Table 4.1.

Stage	Transition predictors	Transition	
Preintention	Self-efficacy (+) Outcome expectations (+)	Progression	
Intention	Risk perception (+) Action planning (+) Coping planning (+)	Progression	
	Self-efficacy (+) Action planning (-) Coping planning (-)		Regression
	Self-efficacy (-)		
Action	Action planning (-) Coping planning (-) Maintenance self-efficacy (-)	Regression	

Note. (+) indicates high levels of the predictor, (-) indicates low levels of the predictor

Table 4.1. Main study hypotheses

4.2. Method

4.2.1. Participants and procedure

Recruitment took place in dental practices in Berlin, Germany. Practice staff informed eligible individuals about the study at the reception. Exclusion criteria were not being of full age and having full prosthetics. Interested patients were then given Time 1 questionnaires. Informed consent was obtained from 488 persons. After the dental examination, participants were given a sample of dental floss or interdental brushes, depending on the dentist's recommendation, and instructions for their usage. Follow-up questionnaires assessing behavioral stage were sent four weeks after the initial assessment, together with pre-paid return envelopes. Non-responding participants ($n = 272$) were reminded by telephone two weeks after sending out questionnaires.

Time 2 questionnaires were returned by 288 (59.01%) participants, 68.2% of them being female. Mean age was 45.03 ($SD = 16.59$), with a range from 18 to 83 years. With regard to dental status, 7 participants (2.3%) indicated "natural teeth", 88 (30.7%) indicated "natural teeth with fillings", 166 (57.3%) indicated "natural teeth with fixed dentures", and 27 (9.5%) indicated "natural teeth with removable dentures".

The study was conducted in accordance with the declaration of Helsinki, version VI [48].

4.2.2. Instruments

The Time 1 questionnaire assessed interdental hygiene behavior, subjective dental status (natural teeth, filled/decayed teeth, removable dentures, fixed dentures), gender and age as well as the following potential predictors of transitions (all taken from [37] unless otherwise indicated): *Risk perception* was measured with three items (Cronbach's $\alpha = .73$) such as "How likely is it that you will conceive caries?" Answers were given on a five-point Likert scale from "very unlikely" (1) to "very likely" (5). *Positive outcome expectations* were assessed with seven items (Cronbach's $\alpha = .71$) such as "If I clean my interdental spaces regularly, my teeth will feel cleaner." *Action planning* (Cronbach's $\alpha = .88$) and *coping planning* (Cronbach's $\alpha = .89$) were measured with the Action Planning and Coping Planning scales [34]; five items each such as "I have made a detailed plan when to clean my interdental spaces" (action planning) or "I have made a detailed plan how I will deal with bleeding" (coping planning). The *maintenance self-efficacy* scale was adapted from Scholz, Sniehotta, & Schwarzer [23] and comprised six items (Cronbach's $\alpha = .88$) such as "I am confident that I can maintain cleaning between my teeth even if I don't see immediate success." *Intention to clean daily* was measured with the item "I intend to clean my interdental spaces daily." The response format for all items was a four-point Likert scale with "totally disagree" (1), "disagree" (2), "agree" (3) and "completely agree" (4). *Interdental hygiene behavior* was assessed by asking par-

ticipants “How often have you cleaned your interdental spaces during the last week?” This self-report measure of interdental hygiene has proven valid in previous research; correlations with residual floss range between $r=.59$ [47]; $r=.69$ [49] and $r=.80$ [50].

Behavioral stages at Time 1 and Time 2 were computed from the answers to the intention item “I intend to clean my interdental spaces daily” and the behavior assessment: Participants indicating that they did not intend to clean their interdental spaces daily by ticking “disagree” or below were allocated to *preintention* (1). Participants scoring “agree” or above were classified to *intention* (2). Participants in *intention* were further subdivided in those who cleaned between their teeth seven or more times per week (*action*) (3).

Change of stage was assessed by subtracting Time 1 stage from the Time 2 stage measure.

4.2.3. Analytical procedure

Data were analyzed using separate discriminant function analyses for *preintentional*, *intentional* and *actional* participants at Time 1 with stage transitions as grouping variables and all baseline variables including age and dental status as predictors. Discriminant function analysis is identical to MANOVA, however, it emphasizes the prediction of group membership from a set of predictors rather than analyzing whether group membership is associated with mean differences.

Significant predictors of group membership (i.e. stage transitions) were then evaluated with Tukey Honest Significant Difference (HSD) post hoc tests to adjust for multiple comparisons, if applicable. All analyses were conducted using SPSS 13.0.

4.3. Results

4.3.1. Dropout analyses and missing values

Dropout analyses were performed by comparing baseline scores between those who continued at Time 2 ($n = 288$) and those who discontinued after baseline ($n = 200$). Participants who continued scored significantly higher on maintenance self-efficacy, action planning, coping planning, intention to clean daily, and were older (all $ps < .01$; independent samples t -Tests). More men than women dropped out of the study ($\chi^2 = 8.51$, $df = 1$; $p < .01$), and participants remaining in the study were more likely to be in *intention* or *action* stage ($\chi^2 = 7.85$, $df = 2$; $p < .05$).

Missing values at Time 1 were below 5% for all variables. Thus, missing values on predictor variables were imputed using the Expectation-Maximization method in SPSS 13.

4.3.2. Stage distribution

At Time 1, 128 participants were in the *preintention stage*, 55 in the *intention stage* and 105 in the *action stage*. At Time 2, 116 participants were in *preintention*, 67 in *intention*, and 105 in *action*.

Stage	Regress		Static		Progress		Total Time I	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Preintention	/	/	98	76.56	30	23.44	128	44.44
Intention	18	32.73	14	25.45	23	41.82	55	19.10
Action	23	21.90	82	78.10	/	/	105	36.46
Total	41	14.24	194	67.36	53	18.40	288	100

Table 4.2. Changes of Stages as a Function of Stage Time I

4.3.3. Longitudinal prediction of stage transitions

In order to assess stage transitions, baseline measures of stage were subtracted from Time 2 stages. Positive values (coded 1) indicate progression, zero (coded 0) indicates remaining in the same stage, and negative values (coded -1) indicate regression. Table 4.2 shows stage progression/regression as a function of baseline stage. Stage transitions were significantly influenced by baseline stage ($\chi^2 = 90.99$; $df = 4$; $p < .01$). Overall, fewer participants regressed than progressed. Participants in preintention were more likely to progress to intention or action than participants in the intention stage. Participants in intention were more likely to regress than participants in action.

Stage transitions were predicted by discriminant function analyses with the three groups of participants regressing (-1), remaining static (0) and progressing (1) as grouping variables. These analyses were run separately in the three stage groups from Time 1 (see Table 4.3).

Predictor of stage transitions	<i>dfs</i>	Regress <i>M</i>	Static <i>M</i>	Progress <i>M</i>	Univariate <i>F</i> _s	Effect sizes η^2 (ω^2)
Preintention stage	(1,126)					
Action planning			2.87 _a	3.30 _a	9.50**	.07 (.07)
Intention stage	(2,52)					
Self-efficacy		3.41 _b	3.83 _b	3.69	2.79 [†]	.09 (.05)
Coping planning		2.72 _c	3.20	3.27 _c	2.48 [†]	.10 (.06)
Action stage	(1,103)					
Self-efficacy		3.73 _d	3.89 _d		6.22**	.06 (.05)

Note. ** $p < .01$; [†] $p < .10$. Variables with the same subscript indicate significant differences ($p < .05$) on the basis of Least Significant Difference test for participants in the preintentional as well as actional stage and Tukey's Honest Significant Difference post hoc tests for participants in the intentional stage.

Table 4.3. Means, *F*s and Effect Sizes for Variables That Predict Stage Transitions

For each stage transition group, the predictors correctly classified the participants in excess of 11% better than could be expected by chance (range = 11.7% - 22.4% improvement in classification as compared to chance, with chance being 1/3).

For participants in *preintention* at Time 1, pairwise *F* analyses contrasting progressing against static persons showed that stage progression could be significantly predicted by action planning $F(1,126) = 9.50, p < .01$. The function yielded a Wilks's λ of .93. An ANOVA was conducted comparing progressing with static participants, indicating that progressers scored significantly higher on action planning. Effect sizes (η^2 and ω^2) for action planning were however small (both .07).

In *intention*, two functions with a combined $\chi^2 = 21.74; df = 5; p < .01$, were found. Wilks's λ decreased from .83 in the first to .61 in the second step. The functions with maintenance self-efficacy and coping planning as predictors significantly discriminated regressing from static $F(2,52) = 13.34; p < .01$ and from progressing participants $F(2,52) = 5.53; p < .01$. Because of the small cell size, the prediction of stage progression reached only borderline significance, $F(2,52) = 2.39; p < .10$. In order to examine the significance of mean differences between the predictors in the transition groups, a MANOVA with maintenance self-efficacy as well as coping planning as dependent variables and stage change as factor was conducted.

Tukey HSD post hoc tests showed that regressors scored significantly lower on maintenance self-efficacy and coping planning than those remaining static. For both variables, the overall *F*s reached only borderline significance: $F(2,52) = 2.79$ for maintenance self-efficacy, and 2.48 for coping planning, respectively (both *ps* < .10). Again, effect sizes were small with $\eta^2 = .09$ and $\omega^2 = .05$ for maintenance self-efficacy and $\eta^2 = .10$ and $\omega^2 = .06$ for coping planning.

For participants in *action* at Time 1, pairwise *F* analyses contrasting progressers with static persons showed that stage regression was significantly predicted by maintenance self-efficacy $F(1,103) = 6.22, p < .01$. The function yielded a Wilks's λ of .94. An ANOVA indicated that regressors scored significantly lower on maintenance self-efficacy than remainers. Effect sizes ranged between $\eta^2 = .06$ and $\omega^2 = .05$.

4.4. Discussion

This study provided evidence that different stage transitions from three superordinate stages of behavior change can be predicted by different social cognitive variables. Factors derived from social-cognitive theories of health behavior can predict longitudinal stage transitions while controlling for sociodemographic variables and subjective health status and differ for transitions from a preintentional, and intentional and an action stage. This supports the assumption of three qualitatively different stages of behavior change that may represent the common denominator of

current stage theories and underpins findings from research on various stage theories (e.g., [51-53]). The present study also supports claims to acknowledge similarities in current health behavior theories and to integrate theoretical assumptions [17, 30].

4.4.1. Longitudinal prediction of stage transitions

Contrary to the predictions for the transitions from the preintention stage, motivational factors did not promote progression to the intention or action stage. Instead, action planning constituted the only significant predictor of stage transition. This was not expected, especially since a large body of evidence shows the importance of motivational factors for intention formation, also in the context of oral self-care [37, 50, 54]. Similarly, if-then planning is rather considered important for the translation of behavioral intentions into behavior, requiring that participants have already formed goal intentions.

There are several possible explanations for this unanticipated finding. It might result from participants progressing to the action stage, thus action planning might have promoted quicker transitions as could have been assessed with our design. Additionally, as the behavioral criterion applied in this study (*daily* interdental hygiene) is fairly strict, some participants in the preintention stage might have been cleaning between their teeth on a more irregular basis and, thus, might have profited from action planning in terms of stage progression. However, there is also research showing that planning processes are important throughout all stages of change [55]. Accordingly, previous research on if-then planning and oral self-care behaviors has found no interaction between intentions and planning [37, 47], but rather an independent main effect of planning, which means that the effects of action planning measured as continuous process might not be limited to individuals in the intention stage. Certainly, more research on the effectiveness of planning in promoting stage transitions is called for.

In the intention stage, participants low in maintenance self-efficacy were more likely to regress to the preintention stage, while participants high in coping planning were more likely to progress to the action stage. Due to small group sizes, these overall effects were only marginally significant, effect sizes are however comparable to the significant predictions in the other stages

These results go in line with the theoretical assumptions and evidence outlined above, as self-efficacy is a crucial factor to prevent from problems in action initiation and maintenance [23, 35]. Accordingly, individuals who anticipate being capable to maintain behavior changes in the face of barriers and difficulties would be less likely to regress to the intention stage. Participants scoring high on coping planning were more likely to progress to the action stage. This finding corroborates the idea that the anticipation of possible barriers and generating coping scenarios provides an effective means to maintain behavior and to prevent lapses [34].

Regression from the action stage was predicted by maintenance self-efficacy. This finding also corresponds with theoretical assumptions. Specific self-efficacy to overcome problems and obstacles is seen as a crucial factor for the maintenance of behavior changes [23, 39].

4.4.2. Limitations

There are a number of limitations to the present study. This study relied on self-reports of behavior, which might be biased. However, previous studies have shown that self-reports of dental flossing can be regarded as valid when compared against the objective measure of residual dental floss [37, 50]. Second, the study faces some problem of selective dropout because more participants intending to clean daily, feeling confident to do so and having made plans continued participation in the study. The rate and selectivity however is comparable to that in similar studies [14, 51, 56]. Thus, although some caution is warranted in generalizing the results of this study, this limitation should not seriously undermine the results.

4.4.3. Implications

This study was the first one to examine commonalities in current stage theories by predicting stage transitions. The identification of stage-specific predictors of stage transitions based on social-cognitive theories implies qualitative differences between the three stages and, thus, supports the idea of three superordinate stages of behavior change. These three stages - preintention, intention, and action - constitute a common denominator of current stage theories such as TTM, PAPM, MAP and HAPA. The identification of stage-specific predictors allows matching interventions to psychologically defined stages of change. This is an improvement compared to the TTM: Designing matched and mismatched interventions for, e.g., the precontemplation and contemplation or action and maintenance stages poses difficulties, as it requires specific matching and non-matching of decisional balance and self-efficacy interventions to stages which differ only with regard to temporal criteria.

However, the actual differences between the predictors in individuals who moved to a different stage and those who maintained all stages were small (Table 4.3). Although differential prediction patterns were found for each stage, further research is needed to test whether stage-tailored interventions show better clinical or cost-effectiveness than interventions that are not matched to stages. The data certainly imply that the idea of behavior change as a linear process underlying social cognition models is an oversimplification of the process of change.

The finding that progression from the preintention stage could be predicted by action planning implies that persons who have not yet formed explicit intentions might also profit from if-then planning. This replicates findings by Armitage [55], which showed that if-then plans were also

effective in promoting stage progression for participants in the precontemplation and contemplation stages. The author regards this finding as being particularly encouraging, because progression from these early stages usually poses the most challenging task for health promotion interventions.

According to our findings, participants in the preintention stage would benefit from planning interventions, whereas individuals in the intention stage should receive interventions to strengthen their perceived self-efficacy and to generate plans on how to overcome barriers. In order to help persons with maintenance in their action stage, they should also be targeted with interventions fostering self-efficacy.

4.5. Acknowledgement

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