

Stages of health behaviour change
and planning:
RCT of stage-specific effects of planning
on dental flossing

5

Abstract

Stage theories of health behavior change assume qualitative differences between stages. To test this, individuals in the motivational ($n = 56$) and volitional ($n = 32$) stages were randomly assigned to a planning intervention or a control condition in a RCT on dental flossing with three measurement points over eight weeks. Planning is a validated post-intentional strategy for behavior change and is thus matched to volitional individuals decided to change and mismatched to motivational individuals not yet decided to change behavior. A repeated-measures ANOVA with stage and intervention group as factors revealed that stage moderated the effectiveness of planning. Besides a main effect of the intervention, volitional participants receiving the planning intervention outperformed motivational participants in the planning condition at both follow-up measurements. This implies that planning is a viable strategy to facilitate health behavior change and supports the idea of two qualitatively distinct stages of health behavior change.

Key words

Stage theories, planning, self-regulation, dental flossing, matched-mismatched test

5.1. Introduction

Effective health promotion requires theory- and evidence-based interventions (Rothman, 2004). A sound theoretical framework allows not only developing successful interventions but also explaining and interpreting intervention results, which without theoretical foundation might be incomprehensible (Noar and Zimmerman, 2005). However, even if theoretical frameworks are applied, often models with weak empirical evidence are used to design and evaluate interventions because of their face validity and appeal for practical use.

For example, many health promotion programs have been based on motivational theories which are useful for *predicting* behavior rather than representing a toolbox to actually *change* behavior. Motivational theories, such as the Theory of Planned Behavior (TPB; Ajzen, 1991), Social Cognitive Theory (SCT; Bandura, 1997) or Protection Motivation Theory (Maddux and Rogers, 1983) propose intentions as central determinant of behavior. However, evidence from research on intention-behavior relations suggests that intentions as indicators of individual motivation to engage in health-related behavior constitute an insufficient predictor of actual health behavior, leaving large amounts of behavioral variance unexplained (Sheeran, 2002). This phenomenon has been labeled “intention-behavior-gap”. Accordingly, a meta-analysis on interventions based on the TPB found inconsistent and sparse evidence for the effectiveness of this theory in changing behavior (Hardeman *et al.*, 2002). Problems with such motivational interventions are especially prominent in preventive behaviors which need to be executed regularly in order to be effective, such as dental flossing. For example, in an intervention study based on SCT (McCaul *et al.*, 1992), participants receiving an intervention manipulating their flossing intentions outperformed controls only as long as additional support (weekly follow-up sessions with a dental hygienist) was provided. As soon as the follow-up sessions ceased, flossing frequency approached baseline measures. This indicates that the regular execution of repetitive health behaviors may depend on factors not included in motivational theories with intentions as central predictor of behavior.

5.1.1. Stage theories of health behavior

In contrast to motivational theories, stage theories assume that during the process of health behavior change, individuals move through an ordered set of qualitatively different stages.

Individuals in the same stage profit from similar factors; individuals in different stages benefit from different factors in terms of progressing through the stages towards behavior maintenance (Weinstein *et al.*, 1998b). This central assumption of stage theories makes them a promising tool for changing behavior, as it allows to match health promotion interventions to stages: While a variable *a* (e.g., risk perception) may be efficient in moving individuals from stage 1 to stage 2, it

might be ineffective in moving individuals from stage 2 to stage 3. Here, another variable b (e.g., planning) might be more effective. Interventions taking this into regard can be more effective than one-size-fits-all-interventions as derived from theories with intentions as central determinant of behavior, because they avoid unnecessary information and prevent reactance.

5.1.2. Two stages of behavior change

Stage theories, such as the Transtheoretical Model (TTM; Prochaska and DiClemente, 1992), the Precaution Adoption Process Model (PAPM; Weinstein *et al.*, 1998a) or the Health Action Process Approach (HAPA; Schwarzer *et al.*, in press) differ in number of stages and factors relevant for stage progression. However, all of them differentiate people who have not yet decided to change behavior from those who have already decided to change or implemented behavior changes (Heckhausen and Gollwitzer, 1987; Renner and Schwarzer, 2003; Weinstein *et al.*, 1998b). Thus, the common denominator of all these stage theories are two meta-stages, namely a *motivational* stage, where individuals have not yet made a decision to act and a *volitional* stage, in which individuals implement this decision and maintain it. In the motivational stage, individuals go through the process of goal setting, which includes becoming aware of the risky nature of concurrent behavior (risk perception), accumulating information about advantages and disadvantages of changing behavior (outcome expectations, attitudes or decisional balance), weighing this information and evaluating subjective capabilities for initiating behavior change (self-efficacy). At the end of this deliberative process, individuals will decide to take up behavior or not. If the decision towards behavior is positive, this reflects the commitment to a goal, e.g. the intention to use dental floss regularly, resulting from feeling at risk for caries, being convinced of the advantages of flossing and feeling capable to floss regularly. As soon as this commitment is being made, initiation and maintenance of behavior change are the central tasks, and motivational processes become irrelevant and move out of the focus of information search (Heckhausen and Gollwitzer, 1987). In this volitional stage, processes that facilitate behavior enactment, such as if-then planning (implementation intentions; Gollwitzer and Sheeran, 2006) are important. Accordingly, evidence demonstrates if-then planning to be particularly effective when goal intentions are high (Scholz *et al.*, 2007; Sheeran *et al.*, 2005).

5.1.3. Evidence for stage theories

The most appealing feature of stage theories, the possibility to match interventions to stages, also provides the strongest test for the assumption that stages of behavior change differ qualitatively (Weinstein *et al.*, 1998b). Interventions matched to one specific stage and mismatched to other stages should be effective only for participants in the matched stage; otherwise the idea of quali-

tatively distinct stages would be obsolete. However, the evidence for the superiority of stage-matched interventions for health behaviors, such as physical activity (Adams and White, 2005; Blissmer and McAuley, 2002) or nutrition (De Vet *et al.*, 2005a) is modest at best (for an overview, see Bridle *et al.*, 2005). The relative failure of stage-matched interventions might be due to several factors, e.g. lack of validity of the algorithm that assigns individuals to their respective stages, ineffective intervention material or invalid assumptions of the stage theory about factors relevant in the different stages (Adams and White, 2005).

Successful applications of stage theories for stage-matched interventions have mostly been based on less and broader stages, rather than 5 (TTM) or 7 (PAPM) finer-graded stages: For example, Dijkstra *et al.* (1998) found support for matching interventions to smokers with low and high readiness to quit respectively insofar that smokers with a high readiness profited more from matched interventions as compared to controls. Weinstein *et al.* (1998a) provide support for a two-stage distinction in a study on radon testing: Information about radon and testing in general was more effective for participants not yet decided to test, while participants decided to test profited from information on how to order and use test kits. In a study on dental flossing, a self-monitoring intervention matched to participants in the volitional stage was more effective in volitional participants than in motivational participants (Schüz *et al.*, in press).

In sum, experimental evidence supports the idea of two qualitatively different stages (e.g., low readiness to quit vs. high readiness to quit or not decided vs. decided), differentiating between individuals in the motivational and volitional stage of behavior change. This study therefore aims at providing more support for distinguishing two stages by testing stage-specific effects of a planning intervention matched to participants in the volitional stage and mismatched to those in the motivational stage. It is the first to do so in the context of dental health behaviors.

5.1.4. Planning

If-then planning (implementation intentions or action planning; Gollwitzer and Brandstätter, 1997; Sniehotta *et al.*, 2005; Ziegelmann *et al.*, 2006) has in a multitude of studies proven to be a useful strategy to promote health behavior change. In a recent meta-analysis, if-then planning yielded medium to large effects on behavior (Gollwitzer and Sheeran, 2006).

If-then plans are simple with regard to their structure: A description of a situation, as precise as possible (if-condition), is linked to a behavioral response (then-component). This structure then has to be encoded (e.g., by repetition or by mental simulation: visualizing situation and response). As soon as the situation specified in the if-condition of the plan is encountered, the cognitive representations of the behavioral response for this situation are highly accessible; behavior enactment thus becomes much more likely. Distractions are shielded, and the intended behavior

becomes prioritized above other behavioral tendencies. This effect has been demonstrated in laboratory research (e.g., Webb and Sheeran, 2004) as well as in field experiments on various health behaviors from physical activity (e.g., Sniehotta *et al.*, 2005) to reducing dietary fat intake (e.g., Armitage, 2004) and daily health behaviors, such as taking vitamin supplements (Sheeran and Orbell, 1999).

5.1.5. Planning and dental flossing

Dental flossing is another good example for such repetitive daily health behaviors. It is an effective means for the prevention of caries and periodontitis (Bellamy *et al.*, 2004). Caries and periodontitis do not only seriously impair quality of life with toothaches or loss of teeth (John *et al.*, 2004), they are also seen as risk factors for cardiovascular disease (Khader *et al.*, 2004), because bacteria from the infected gums in the blood circuit can cause cardiac inflammation. In order to effectively prevent oral health problems, dental flossing has to be carried out on a regular, at best daily basis (ADA, 2005). Although flossing is not a complex behavior, prevalence is very low (Bader, 1998). This makes it an interesting subject for studies on planning. In a study on university students, planning emerged as best psychosocial predictor of adherence to a daily flossing regimen (Schüz *et al.*, 2006). Sniehotta *et al.* (2007) provided evidence that planning exactly when, where, and how to use dental floss facilitated dental flossing frequency, irrespective of behavioral intentions.

This study therefore aims at testing differential effects of an action planning intervention on dental flossing and at examining whether this intervention is most effective in participants in the stage it is matched to, i.e. the volitional stage.

5.1.6. Research questions

Based on the idea that if-then planning facilitates the enactment of health behaviors and that planning works best in volitional individuals, this study has the following aims in particular:

- (i) To test the efficacy of an intervention based on action planning with regard to dental flossing
- (ii) To test if this intervention is more effective in the stage it is matched to (i.e., the volitional stage) than in the stage it is mismatched to (i.e., the motivational stage), thus supporting the idea of qualitatively different stages in the process of health behavior change.

These research questions were addressed in a RCT with three measurement points over a period of eight weeks.

5.2. Method

5.2.1. Participants and procedure

Participants were approached by trained students during an open day at Freie Universität Berlin, Germany (see Figure 1 for participant flow through the study). The longitudinal sample ($n=85$) comprised of 66.9 % women, was on average 34.33 years of age ($SD=13.31$; [18-71]), and fairly high educated with 41.1% holding A-levels and 38.5% having some university degree. Inclusion criteria were being of full age and not wearing full prosthetics.

After giving informed consent, all participants received sample boxes of dental floss (5m) and were given a postcard listing advantages of dental flossing (improved hygiene, effective prevention of caries and periodontal disease) as well as flossing instructions based on the recommendations of the American Dental Association (ADA, 2005). Participants were then asked about their dental flossing behavior, their stage was assessed, and they were randomly assigned to either the control or the action planning condition.

Time 2 questionnaires assessing dental flossing frequency and socioeconomic data were sent two weeks later with another sample of dental floss and a prepaid return envelope. Time 3 questionnaires assessing dental flossing frequency were sent with a prepaid return envelope six weeks after Time 2. Non-responding participants at Time 2 and Time 3 (i.e. not responding after two weeks) received one reminder phone call.

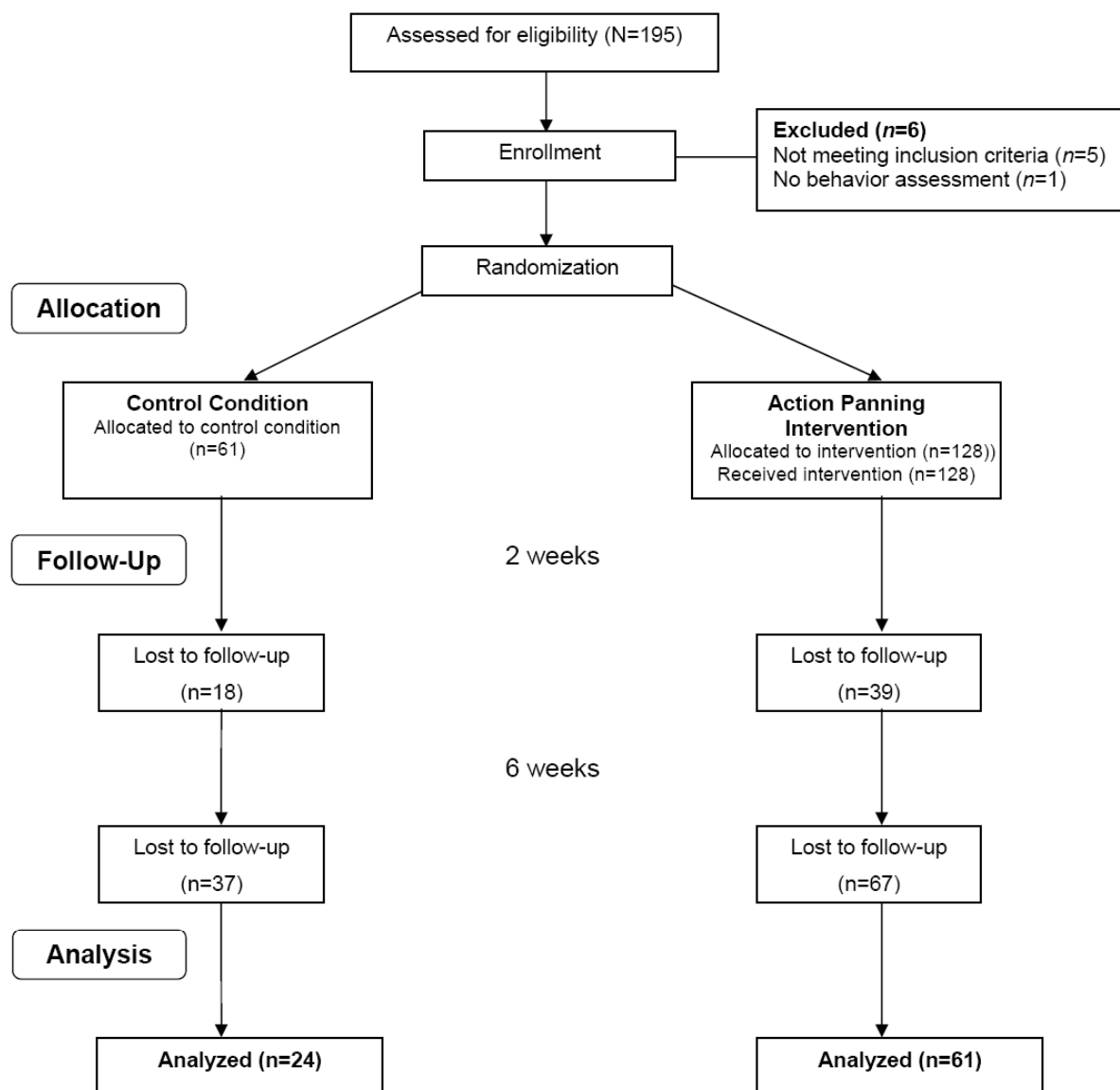


Figure 5.1: Study Flowchart

5.2.2. Measures

The main study outcome was a seven-day-recall of dental flossing. Participants were asked “How often did you use dental floss *during the last seven days?*” and filled in a free response format. Participants who did not use dental floss during the last seven days were asked how often they used floss during the last month. This primary outcome measure was adopted from previous research and has proven valid when compared to a measure of residual dental floss (Schüz *et al.*, in press; Schüz *et al.*, 2006; Sniehotta *et al.*, 2007).

Stages were assessed using a staging algorithm based on Weinstein *et al.* (1998a) and adapted to dental flossing. After the question “Are you currently using dental floss?”, participants answering

“no” were asked to choose one of the following alternatives: (i) ‘I know what to use dental floss for’, (ii) ‘I have thought about using dental floss’, or (iii) ‘I have resolved to use dental floss’. Participants answering “yes” were asked to choose one of the following alternatives: (iv) ‘I don’t use dental floss as often as intended’ (v) ‘I use dental floss as often as intended’, or (vi) ‘Flossing is habitual to me and requires no effort at all’. According to the stage assumptions outlined above, participants answering items (iii), (iv), (v), and (vi) were classified as *volitional*, because they indicated the intention to floss, and participants answering items (i) or (ii) were being classified as *motivational*.

5.2.3. Intervention

The action planning intervention was delivered by trained interviewers. Interventions were adapted from Snichotta *et al.* (2005). Participants were read the statement “You are more likely to regularly clean between your teeth if you make an exact plan *when*, *where*, and *how* you will do so. Please write down your plan in the table below. The more precise, concrete, and personal you formulate your plan, the more it will help you.” The table contained columns entitled “When?”, “Where?”, “With what?”, and “How often per week?” After filling in their plans, participants were asked to visually imagine themselves in the situations specified in their plans. Participants were invited to ask the interviewers in cases of misunderstandings or other problems.

5.2.4. Randomization procedure

Participants were allocated to intervention or control group according to a time schedule with randomly generated shifts. Interviewers changed experimental conditions every thirty minutes according to these shifts over the open day space of time (e.g., from 10:00 to 10:30, all participants received the action planning intervention, from 10:30 to 11:00, all participants were allocated to control condition, etc.). This procedure resulted in a relatively even distribution of participants to experimental groups (see Figure 1).

5.2.5. Dropout analyses

Participants who took part in all three measurement points were compared with those who ceased participation after Time 1 assessments with regard to dental flossing frequency, stages, and group distribution at baseline. No significant differences were found with regard to dental flossing ($t = -1.05$, $df=187$, $p=.30$) and experimental group ($\chi^2 = 1.15$, $df=1$, $p=.28$), indicating that the longitudinal sample was representative of the whole sample with regard to these variables. With regard to stages however, significant differences between participants remaining in the study and drop-outs were detected ($\chi^2 = 4.07$, $df=1$, $p<.05$), indicating that participants in earlier stages of behavior change were more likely to drop out of the study.

5.2.6. Missing values

One person did not provide information on flossing frequency at Time 2 and Time 3 and was thus excluded from further analyses. Stage assessments were available from all participants.

5.2.7. Analytical procedure

Repeated-measures analyses of variance with dental flossing at the three measurement points as within-subjects factor and group assignment, as well as stage as between-subjects factors were conducted in order to evaluate the effects of the planning intervention.

5.3. Results

Overall mean flossing frequency per week increased from 1.99 at baseline to 4.19 at Time 2 and 4.32 at Time 3. At baseline, this is well below the ADA recommendations for daily flossing (ADA, 2005).

5.3.1. Randomization checks

A univariate analysis of variance with group as factor and baseline flossing frequency as dependent variable was conducted to check randomizations. The randomization was successful $F(1,187) = 1.65, p = .20$, indicating that the experimental groups did not differ with regard to baseline flossing frequency. Similarly, stages were distributed equally across experimental groups ($\chi^2 = 3.81, df = 6, p = .70$).

5.3.2. Stages

31 participants (19 of them female) of the longitudinal sample were classified as *volitional*, 54 (33 of them female) were classified as *motivational*. At baseline, volitional participants used dental floss significantly more often than motivational participants (4.34 times compared to .71 times, $t = -8.66, df = 83, p < .01$).

5.3.3. Effects of the intervention

Means and standard deviations of dental flossing frequency across time, stages, and groups are depicted in Table 5.1; the summary of the ANOVA is presented in Table 2.

Intervention group	Stage	Time	Mean	SD
Control	Motivational	1	1.35	1.18
		2	2.88	1.83
		3	2.31	2.72
	Volitional	1	3.55	2.61
		2	4.00	2.39
		3	4.25	3.66
	Overall	1	2.3	2.19
		2	3.37	2.12
		3	3.15	3.24
Planning	Motivational	1	.51	1.05
		2	3.00	2.37
		3	2.59	2.82
	Volitional	1	5.13	3.96
		2	9.25	6.85
		3	9.23	5.10
	Overall	1	2.02	3.24
		2	5.05	5.23
		3	4.76	4.84

Table 5.1: Means and standard deviations (SD) for dental flossing across intervention groups, stages and time

Source	df	SS	MS	F	Partial η^2
Within-subjects					
Time	2	180.32	90.16	13.47**	.14
Time*Intervention	2	55.38	27.69	4.14*	.05
Time*Stage	2	6.50	3.25	.49	.01
Time*Intervention*Stage	2	17.05	8.53	1.27	.02
Error 2	160	1070.93	6.69		
Between-subjects					
Intervention	1	57.05	57.05	8.67**	.10
Stage	1	229.11	229.11	34.83**	.30
Intervention*Stage	2	66.25	66.25	10.07**	.11
Error 1	80	526.19	6.58		

Note. ** $p < .01$; * $p < .05$

Table 5.2: Summary of analysis of variance

Flossing frequency increased over time, indicated by a significant main effect of time ($p < .01$; $\eta^2 = .14$). This speaks in favor of providing participants with floss and flossing instructions in order

to promote flossing. This increase over time, however, was stronger for participants in the intervention group than for participants in the control group, indicated by a significant interaction time*intervention group ($p < .05$; $\eta^2 = .05$). The interaction effect is displayed in Figure 5.2. The differences in flossing frequency between the control group and the planning group were significant at Time 2 and Time 3. Dental flossing frequency between Time 2 and Time 3 was not significantly different within both groups, indicating that the effects of the intervention remained stable over the six-week period.

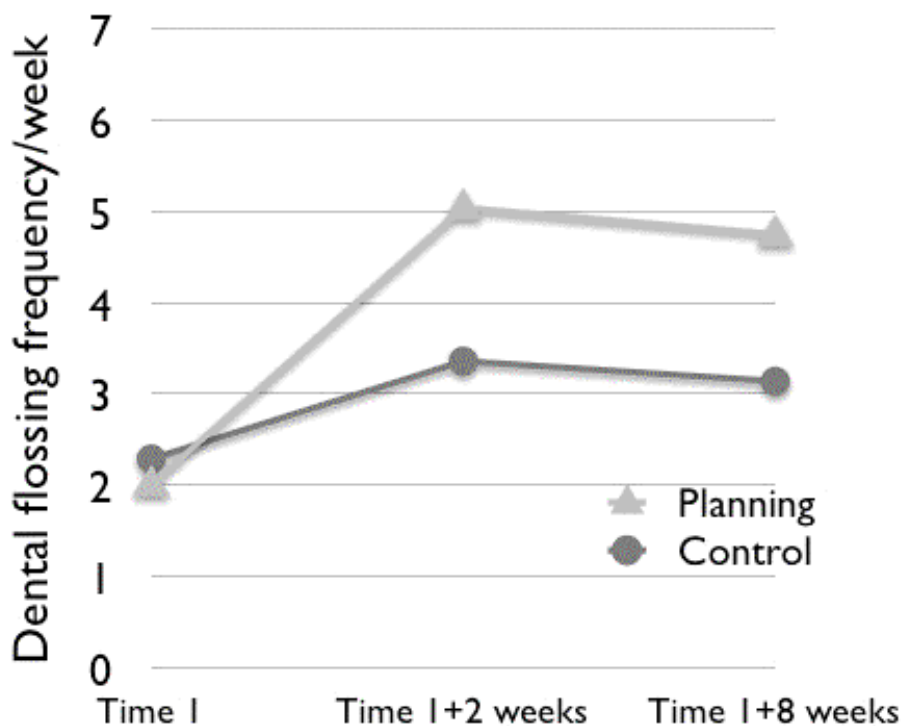


Figure 5.2: Estimated marginal means of dental flossing frequency over time across intervention groups

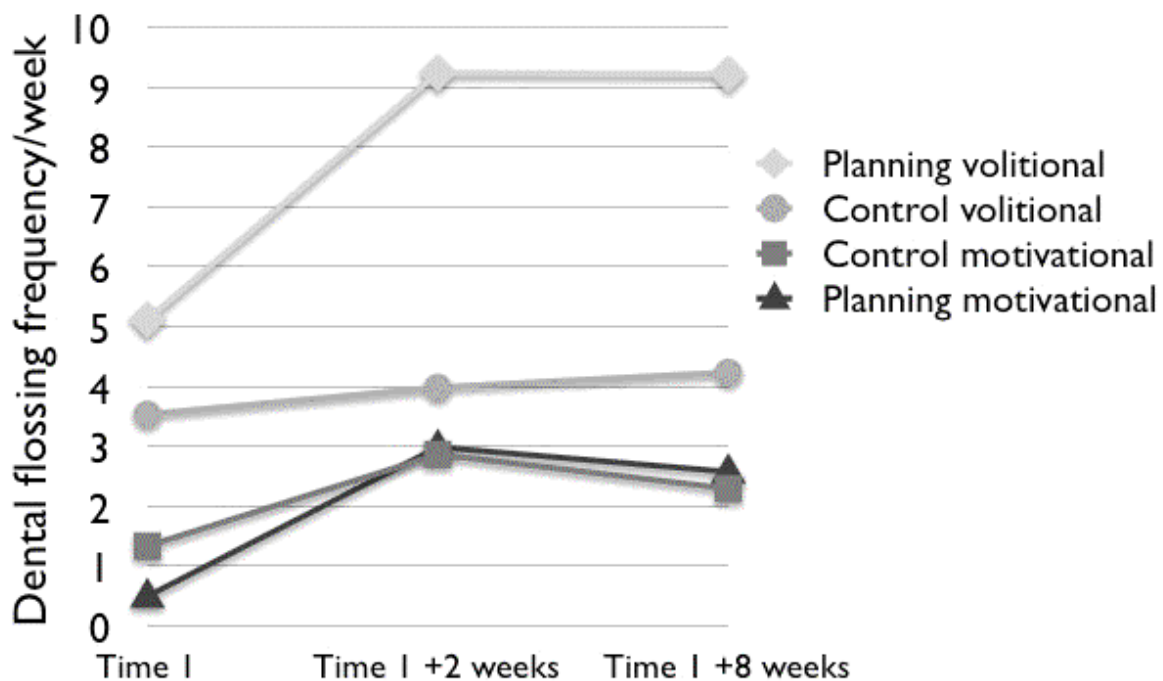


Figure 5.3: Estimated marginal means of dental flossing frequency over time across intervention groups and stages

On the between-subjects level, significant main effects of intervention and stage were found. The significant interaction *intervention*stage* ($p < .01$; $\eta^2 = .11$) indicates that stage moderated the effects of the planning intervention: Volitional participants profited more from the planning intervention than motivational participants. In volitional participants, the planning condition yielded significantly higher flossing frequencies than the control condition. In motivational participants, no effects of the intervention as compared to the control condition were found (Figure 5.3). This indicates that the planning intervention had no effects on flossing frequency in these participants on top of the provision of floss and instructions. Thus, the stage-matched intervention was effective in promoting health behavior change whereas the stage-mismatched intervention was not.

5.4. Discussion

This study aimed at testing the effects of a planning intervention on dental flossing frequency and at examining whether this intervention is most effective in the volitional stage of health behavior change, thus providing evidence for the assumption of two qualitatively different stages of health behavior change (Weinstein *et al.*, 1998b).

5.4.1. Planning and dental flossing frequency

On both the within-subjects and the between-subjects level, significant main and interaction effects of the intervention were found, indicating that participants receiving the intervention flossed significantly more often than participants in the control condition. This effect remained stable over the two follow-up points of measurement, indicating that with regard to dental flossing, action planning is able to support sustaining behavior change. This replicates earlier findings that formulating plans facilitates sustaining changes in health behavior (Gollwitzer and Sheeran, 2006).

5.4.2. Stage-specific effects of planning

In order to detect whether the action planning intervention was most effective in participants in the volitional stage, which it was matched to, participants in the two different stages and treatment groups were compared with regard to their dental flossing frequency. The differences between volitional participants receiving the planning intervention, controls, and participants in the motivational stage in both conditions were significant at both Time 2 and Time 3, indicating that volitional participants profited more from the planning intervention than motivational participants. This supports the idea of at least two qualitatively different stages in health behavior change, a motivational and a volitional stage as implied e.g., in the HAPA (Schwarzer *et al.*, in press).

The finding that planning is most effective in participants who have already decided to change their behavior replicates earlier findings with regard to the dependence of planning on antecedent behavioral intentions (Lippke *et al.*, 2004; Sheeran *et al.*, 2005). Formulating if-then plans facilitates the implementation and maintenance of behavior only if participants actually intend to perform behavior. If participants hold no intention to act, prompting participants to form action plans will not facilitate behavior change and could even lead to reactance. In these undecided participants, other strategies and variables to promote the contemplation process might be more effective, e.g. the promotion of risk perception (Weinstein, 1988), positive outcome expectations or self-efficacy (Bandura, 1998). For an overview of stage-specific predictors of behavior change, see De Vet *et al.* (2005b).

The finding of stage-specific effects of planning also supports the idea that there are indeed qualitative differences between motivational and volitional individuals, at least with regard to the effects of if-then planning. It also implies that parsimonious interventions, such as a planning intervention requiring only a few minutes, can promote significant changes in behavior, when targeted at individuals in the volitional stage.

5.4.3. Limitations

There are some limitations to the present study that deserve discussing. First, there was some selective dropout, with more participants in the volitional stage remaining in the study. With planning, participants in the motivational stages received an intervention mismatched to their stage-specific needs. The effect that participants in the mismatched group drop out more likely is often found in stage-based intervention studies (Prochaska *et al.*, 1993) and might be due to participants' reactance when receiving inappropriate treatments. There were, however, no baseline differences between dropouts and participants remaining in the study with regard to flossing frequency. Second, there was no intervention specifically matched to the motivational stage and mismatched to the volitional stage. Thus, taken strictly, this study provides only half of a matched/mismatched research design. However, the finding that stage and treatment produced a meaningful interaction still speaks in favor of qualitative differences between motivational and volitional participants. Future studies should apply a research design addressing matched and mismatched interventions to both motivational and volitional participants as to provide stronger evidence for the stage assumptions. Third, the attrition rate was quite high, leaving a longitudinal sample of only 88 participants with interpretable data. The attrition rate might be due to the fact that participants were unpaid. Additionally, they were not recruited in a clinical setting or in a setting where they had to sign up for a study, but were proactively recruited during the university open day. Thus, they might have not contemplated participating in a study on dental flossing before and might drop out later more easily. Fourth, the study sample was fairly well educated. Health behaviors, especially dental flossing, commonly correlate with education (Rimondini *et al.*, 2001), therefore this sample cannot be considered representative for the general population. However, with initial levels of 2.16 times flossing per week, this sample also performs well below the recommendations for daily flossing (ADA, 2005). Fifth, the dependent variable in the study was self-reported health behavior. This measure, however, was validated in previous research, showing correlations with residual floss between .56 (Sniehotta *et al.*, 2007) and .69 (Schüz *et al.*, in press).

5.4.4. Implications and conclusions

The two main findings from this study - that a planning intervention produces sustaining changes in dental flossing frequency and that this intervention is most effective in volitional participants - bear some important implications.

Formulating action plans constitutes an economic and effective intervention to facilitate health behavior, which can easily be implemented in practical settings. In the dental context, for example, dentists or dental hygienists could, after giving instructions, tell their patients to formulate

action plans for dental flossing by asking them to imagine themselves flossing in a specific situation, and at best, after having assessed patients' motivational state of mind as to recommend this only to patients in the volitional stage.

The finding that the planning intervention was most beneficial in volitional participants encourages the idea of targeting interventions to different stages. Although this may be accompanied by several problems, e.g. validity of stage algorithms and the oversimplification of complex change processes (Bridle *et al.*, 2005), it may prevent participants from mismatched and thus frustrating interventions and can produce sustainable health behavior changes.

5.5. Acknowledgement

This study was supported by a grant from Oral-B Gillette Germany to the first author.

The authors would like to thank Monika Berus, Melanie Conradt, Franziska Heimrich, and Nadia Matysiak for their assistance with data collection.

5.6. References

- ADA. (2005). Cleaning Your Teeth and Gums (Oral Hygiene). Retrieved August 14th, 2006, from http://www.ada.org/public/topics/cleaning_faqs.asp#4
- Adams, J., and White, M. (2005). Why don't stage-based activity promotion interventions work? *Health Educ. Res.* 20(2): 237-243.
- Ajzen, I. (1991). The theory of planned behavior. *Organ. Behav. Hum. Dec.* 50(2): 179-211.
- Armitage, C. J. (2004). Evidence That Implementation Intentions Reduce Dietary Fat Intake: A Randomized Trial. *Health Psychol.* 23(3): 319-323.
- Bader, H. I. (1998). Floss or die: implications for dental professionals. *Dentistry Today*, 17(7), 76-78, 80-82.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. Freeman, New York.
- Bandura, A. (1998). Health promotion from the perspective of social cognitive theory. *Psychol. Health* 13(4): 623-649.
- Bellamy, P., Barlow, A., Puri, G., Wright, K. I., Mussett, A., and Zhou, X. (2004). A new in vivo interdental sampling method comparing a daily flossing regime versus a manual brush control. *J. Clin. Dent.* 15(3): 59-65.
- Blissmer, B., and McAuley, E. (2002). Testing the requirements of stages of physical activity among adults: the comparative effectiveness of stage-matched, stage-mismatched, standard care and control interventions. *Ann. Behav. Med.* 24: 181-189.

- Bridle, C., Riemsma, R. P., Pattenden, J., Sowden, A. J., Mather, L., Watt, I. S., *et al.* (2005). Systematic review of the effectiveness of health behavior interventions based on the transtheoretical model. *Psychol. Health* 20(3): 283-301.
- De Vet, E., Brug, J., De Nooijer, J., Dijkstra, A., and De Vries, N. K. (2005a). Determinants of forward stage transitions: A Delphi study. *Health Educ. Res.* 20(2): 195-205.
- De Vet, E., De Nooijer, J., De Vries, N., and Brug, J. (2005b). *Testing the transtheoretical model for fruit intake: Comparing web-based individualized stage-matched and stage-mismatched feedback*. Manuscript under review.
- Dijkstra, A., De Vries, H., Roijackers, J., and van Breukelen, G. (1998). Tailored interventions to communicate stage-matched information to smokers in different motivational stages. *J. Consult. Clin. Psychol.* 66(3): 549-557.
- Gollwitzer, P. M., and Brandstätter, V. (1997). Implementation intentions and effective goal pursuit. *J. Pers. Soc. Psy.* 73(1): 186-199.
- Gollwitzer, P. M., and Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Adv. Exp. Soc. Psychol.* 38: 69-119.
- Hardeman, W., Johnston, M., Johnston, D. W., Bonetti, D., Wareham, N. J., and Kinmonth, A. L. (2002). Application of the theory of planned behaviour in behaviour change interventions: A systematic review. *Psychol. Health* 17(2): 123-158.
- Heckhausen, H., and Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motiv. Emotion* 11(2): 101-120.
- John, M. T., Hujoel, P., Miglioretti, D. L., Leresche, L., Koepsell, T. D., and Micheelis, W. (2004). Dimensions of oral-health-related quality of life. *J. Dent. Res.* 83(12): 956-960.
- Khader, Y. S., Albashaireh, Z. S., and Alomari, M. A. (2004). Periodontal diseases and the risk of coronary heart and cerebrovascular diseases: a meta-analysis. *J. Periodontol.* 75(8): 1046-1053.
- Lippke, S., Ziegelmann, J. P., and Schwarzer, R. (2004). Initiation and Maintenance of Physical Exercise: Stage-specific Effects of a Planning Intervention. *Res. Sports Med.* 12: 221-240.
- Maddux, J. E., and Rogers, R. W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *J. Exp. Soc. Psychol.* 19(5): 469-479.
- McCaul, K. D., Glasgow, R. E., and O'Neill, H. K. (1992). The problem of creating habits: Establishing health-protective dental behaviors. *Health Psychol.* 11(2): 101-110.
- Noar, S. M., and Zimmerman, R. S. (2005). Health Behavior Theory and cumulative knowledge regarding health behaviors: Are we moving in the right direction? *Health Educ. Res.* 20(3): 275-290.

- Prochaska, J. O., and DiClemente, C. C. (1992). The transtheoretical approach. In J. C. Norcross, J.C. and Goldfried, M. R. (Eds.), *Handbook of psychotherapy integration*. Basic Books, Inc, New York, pp. 300-334.
- Prochaska, J. O., DiClemente, C. C., Velicer, W. F., and Rossi, J. S. (1993). Standardized, individualized, interactive, and personalized self-help programs for smoking cessation. *Health Psychol.* 12(5): 399-405.
- Renner, B., and Schwarzer, R. (2003). Social-cognitive Factors in health behavior change. In Suls, J. and Wallston, K. A. (Eds.), *Social Psychological Foundations of Health and Illness*. Blackwell, Oxford, pp. 169-196.
- Rimondini, L., Zolfanelli, B., Bernardi, F., and Bez, C. (2001). Self-preventive oral behavior in an Italian university student population. *J. Clin. Periodontol.* 28(3): 207-211.
- Rothman, A. J. (2004). "Is there nothing more practical than a good theory?": Why innovations and advances in health behavior change will arise if interventions are used to test and refine theory. *Int. J. Beh. Nutr. Phys. Activ.* 1(1): 11.
- Scholz, U., Schüz, B., Ziegelmann, J. P., Lippke, S., and Schwarzer, R. (2007). *Beyond Behavioral Intentions: Planning Mediates Between Intentions and Physical Activity*. Manuscript under review.
- Schüz, B., Sniehotta, F. F., and Schwarzer, R. (2007). Behavioral Stages and Self-Regulation: Testing stage-specific effects of an action control intervention. *Health Educ. Res.* 22(3): 332-341.
- Schüz, B., Sniehotta, F. F., Wiedemann, A., and Seemann, R. (2006). Adherence to a daily flossing regimen in university students: effects of planning when, where, how and what to do in the face of barriers. *J. Clin. Periodontol.* 33(9): 612-619.
- Schwarzer, R., Luszczynska, A., Schüz, B., Ziegelmann, J. P., Lippke, S., and Scholz, U. (in press). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seatbelt use, dietary behavior and physical activity. *Ann. Behav. Med.*
- Sheeran, P. (2002). Intention-behaviour relations: A conceptual and empirical review. In M. Hewstone, M. and Stroebe, W. (Eds.), *European Review of Social Psychology Vol. 12*. Wiley, New York, pp. 1-36.
- Sheeran, P., and Orbell, S. (1999). Implementation intentions and repeated behaviour: Augmenting the predictive validity of the theory of planned behaviour. *Eur. J. Soc. Psychol.* 29(2-3): 349-369
- Sheeran, P., Webb, T. L., and Gollwitzer, P. M. (2005). The interplay between goal intentions and implementation intentions. *Pers. Soc. Psychol. B.* 31(1): 87-98.

- Snichotta, F. F., Scholz, U., Schwarzer, R., Behr, H., Fuhrmann, B., Kiwus, U., *et al.* (2005). Long-term effects of two psychological interventions on physical exercise and self-regulation after coronary rehabilitation. *Int. J. Behav. Med.* 12(4): 244-255.
- Snichotta, F. F., Soares, V. A., and Dombrowski, S. U. (2007). *Randomised controlled trial of a one-minute intervention changing oral self-care behaviour*. Manuscript under review.
- Webb, T. L., and Sheeran, P. (2004). Identifying good opportunities to act: Implementation intentions and cue discrimination. *Eur. J. Soc. Psychol.* 34(4): 407-419.
- Weinstein, N. D. (1988). The precaution adoption process. *Health Psychol.* 7(4): 355-386.
- Weinstein, N. D., Lyon, J. E., Sandman, P. M., and Cuite, C. L. (1998a). Experimental evidence for stages of health behavior change: The precaution adoption process model applied to home radon testing. *Health Psychol.* 17(5): 445-453.
- Weinstein, N. D., Rothman, A. J., and Sutton, S. R. (1998b). Stage theories of health behavior: Conceptual and methodological issues. *Health Psychol.* 17(3): 290-299.
- Ziegelmann, J. P., Lippke, S., and Schwarzer, R. (2006). Adoption and maintenance of physical activity: Planning interventions in young, middle-aged, and older adults. *Psychol. Health* 21(2): 145-163.