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Self-regulation following prostatectomy: Phase-specific self-efficacy beliefs for pelvic-floor exercise

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Objective. Beliefs in one's ability to perform a task or behaviour successfully are described as self-efficacy beliefs (Bandura, 1977). Since individuals have to deal with differing demands during a behaviour-change process, they form phase-specific self-efficacy beliefs directed at these respective challenges. The present study, based on the Health Action Process Approach (Schwarzer, 2001), examines the theoretical differentiation, relative importance, and differential effects of four phase-specific self-efficacy beliefs, including task self-efficacy, preactional self-efficacy, maintenance self-efficacy, and recovery self-efficacy.

Design. In a prospective longitudinal study, 112 prostatectomy-patients received questionnaires at 2 days, 2 weeks, 1 month, and 6 months post-surgery.

Methods. Participants provided data on phase-specific self-efficacies as well as phase indicators of health-behaviour change, that is, intentions, planning, and pelvic-floor exercise. Hierarchical regression analyses were conducted to test the study hypotheses.

Results. Task self-efficacy was not uniquely associated with intentions. Preactional self-efficacy was related to action planning. Maintenance self-efficacy did not predict behaviour. Recovery self-efficacy was associated with re-uptake of pelvic-floor exercise after relapses only.

Conclusion. Findings underline the importance of differentiating between task self-efficacy and preactional self-efficacy during early phases of behaviour change as well as of considering the occurrence of relapses as a moderator of potential effects of recovery self-efficacy on the maintenance of behaviour change. Advanced knowledge on distinct, phase-specific self-efficacy beliefs may facilitate the design of effective tailored interventions for behaviour change.

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Self-efficacy beliefs based on Bandura's (1997) social cognitive theory refer to self-confidence in one's own capacity to prepare, initiate, and maintain behaviour, even if obstacles emerge. Self-efficacy beliefs depend on the context and on the level of perceived difficulty of the behaviour (Bandura, 1997). For example, during the process of health-behaviour change, individuals face different tasks with individually different levels of difficulty: To pass through the health-behaviour change process, individuals first have to form intentions. Afterwards, they have to plan, initiate, and maintain the behaviour, and sometimes recover from relapses (Schwarzer, 2001). Because each phase provides its own specific challenges, phase-specific self-efficacy beliefs specifically concern challenges in respective phases (Marlatt, Baer, & Quigley, 1995). The aim of the present paper was to enhance the existing knowledge on phase-specific self-efficacies (Scholz, Sniehotta, & Schwarzer, 2005; Schwarzer, 2008) by differentiating and testing the predictive validity of *four* phase-specific self-efficacies in health-behaviour change.

Phase-specific self-efficacy beliefs

Beliefs in one's ability to perform a task or behaviour successfully are described as self-efficacy beliefs (Bandura, 1977). Originally, self-efficacy was conceptualized as domain- or action-specific. Later, self-efficacy was related to specific phases in health-behaviour change (Marlatt *et al.*, 1995; Rodgers, Hall, Blanchard, McAuley, & Munroe, 2002). The Health Action Process Approach (HAPA; Schwarzer, 2001) is a model for the investigation of health-behaviour change that places a special emphasis on self-efficacy beliefs, with self-efficacy being an important predictor in all phases of change (Abraham, 2008; Lippke, Ziegelmann, & Schwarzer, 2005; Renner, Spivak, Kwon, & Schwarzer, 2007). The model distinguishes between a preintentional, a preactional phase, and an action phase (Lippke *et al.*, 2005; Scholz *et al.*, 2005; Wiedemann *et al.*, 2009). Phase-specific self-efficacy beliefs are differentiated and supposed to operate differently in these phases of change (Schwarzer, 2001). Previous research mainly focused on three phase-specific self-efficacies (i.e., task, maintenance, and recovery self-efficacy; Schwarzer, 2008). The present study aims at differentiating between four phase-specific self-efficacy beliefs. Specifically, we investigate preactional self-efficacy and newly test its phase-specific predictive validity against preintentional task self-efficacy, maintenance self-efficacy, and recovery self-efficacy. Self-efficacy beliefs are introduced in order of theoretical appearance below.

(1) *Task self-efficacy* is located in the preintentional phase which comprises persons who are not intending to change their behaviour. If individuals believe to be vulnerable to health threats (risk perception) and expect that the uptake of a specific health behaviour has more advantages than disadvantages (outcome-expectancies), they are more likely to form an intention to exercise regularly. Task self-efficacy refers to individuals' overall confidence in their ability to enact a behaviour. High task self-efficacy increases the probability of forming an intention to change behaviour (Renner *et al.*, 2007; Rodgers *et al.*, 2002; Schwarzer *et al.*, 2007).

In the preactional phase, (2) *preactional self-efficacy* helps to pass from intentions to action, when behaviour change is planned and prepared. Planning helps to initiate health behaviour (Leventhal, Singer, & Jones, 1965). In action plans, behaviour is linked to situational cues in pre-deciding when, where, and how to perform the new behaviour (Gollwitzer, 1999; Gollwitzer & Sheeran, 2006). Thus, action planning can be considered as a last preparatory step before action initiation. Action preparation and implementation is supported by preactional self-efficacy, which refers to the confidence in one's ability to prepare and start a new behaviour even if its implementation has to be prepared thoroughly first. Task self-efficacy and preactional self-efficacy have not yet been operationalized as distinct constructs, and preactional self-efficacy has rarely been investigated to date (Chow & Mullan, 2010; Luszczynska & Schwarzer, 2003).

In the action phase of the HAPA, behaviour is protected against or recovered in case of relapses. Evidence emerged that self-efficacy in the preintentional and preactional phase can be distinguished from self-efficacy during the action phase (Luszczynska & Schwarzer, 2003). In the action phase, two further self-efficacy beliefs may help to maintain health behaviour. (3) *Maintenance self-efficacy* refers to beliefs in one's ability to cope with obstacles that may interfere with the maintenance of health behaviour, and is therefore relevant when behaviour is already initiated or enacted (Scholz *et al.*, 2005). (4) *Recovery self-efficacy* is needed to return to the intended behaviour after a relapse. There are consistent findings that maintenance and recovery self-efficacy are crucial to sustain or return to regular performance of various health behaviours (Rodgers *et al.*, 2002; Scholz *et al.*, 2005; Schwarzer *et al.*, 2007).

To sum up, phase-specific self-efficacy beliefs should show different predictive patterns with regard to different phase-specific outcomes of behaviour change, including intentions, planning, and health-behaviour performance. In the present study, phase-specific self-efficacy beliefs are investigated in the context of health-behaviour change following radical prostatectomy.

Pelvic-floor exercise in prostatectomy patients

Prostate cancer is one of the most prevalent cancers in men (Ferlay, Bray, Pisani, & Parkin, 2001). One treatment for localized prostate cancer is radical prostatectomy (RPE; Debruyne & Beerlage, 2000), where the entire prostate is surgically removed. Urinary incontinence as a common post-operative comorbidity sets in immediately post-surgery and recedes within the first 12 months in most patients (Basillote, Ahlering, Skarecky, Lee, & Clayman, 2004). To control post-operative incontinence, patients are recommended to implement pelvic-floor exercise (Hunter, Moore, & Glazener, 2007). There are no general recommendations concerning the training frequency and intensity, but the outer pelvic-floor muscles can be strengthened by several exercise units each day. Patients are encouraged to continue exercising at least as long as incontinence persists (Dorey, Glazener, Buckley, Cochran, & Moore, 2009).

Aims and hypothesis

To our knowledge, previous studies based on the HAPA only investigated three phase-specific beliefs empirically, and did not differentiate between task and preactional self-efficacy (Luszczynska & Schwarzer, 2003; Renner *et al.*, 2007; Scholz *et al.*, 2005). In this study, we focused on testing the *relative impact* and unique predictive validity of four phase-specific self-efficacies on phase-specific outcomes, namely on intentions (preintentional phase), planning processes (preactional phase), and behaviour maintenance including recovery (actional phase). A study design was chosen in which these phase-specific outcomes were assessed at three measurement points after baseline, using two different measurement lags. That is, assessments and time lags in between were meant to parallel theoretically assumed milestones of behaviour change following surgery. In particular, we tested the following hypotheses:

(1) Task self-efficacy (as compared to preactional, maintenance, and recovery self-efficacy) is the strongest predictor for intentions 2 weeks post-surgery.
(2) Preactional self-efficacy (as compared to task, maintenance, and recovery self-efficacy) is the strongest predictor for action planning 2 weeks post-surgery.
(3) Maintenance self-efficacy (as compared to task, preactional, and recovery self-efficacy) is the strongest predictor for pelvic-floor exercise 1 month post-surgery.
(4) Recovery self-efficacy (as compared to task, preactional, and maintenance self-efficacy) is the strongest predictor for pelvic-floor exercise 6 months post-surgery, when actors are more likely to have experienced lapses in behaviour change already.

To further qualify the main effects in terms of phase-specificity, we explored whether the associations between phase-specific self-efficacy beliefs and phase-specific outcomes were moderated by phase indicators (i.e., intention strength, past behaviour, and relapses). For example, high intentions to change one's behaviour may indicate being in the preactional phase. Accordingly, especially individuals with high intentions and high preactional self-efficacy beliefs should report high levels of planning. Past behaviour can be used as an indicator of being in the maintenance phase. Maintenance self-efficacy should be associated more strongly with future behaviour in individuals, who were already active in the past. Lapsing into non-behaviour may indicate being in the recovery phase. Only individuals with setbacks should benefit from their recovery self-efficacy beliefs, as individuals who did not relapse are not in need of a high recovery self-efficacy to return to prior activity levels.

Method

Design and sample

Data were assessed from $N = 112$ in patients of the Department of Urology at a German University Medical Centre. Patients were part of a couple study on adaptation to radical prostatectomy, were all in stable relationships and had comprehensive knowledge of the German language. All patients gave informed consent to participation in the study. Data were assessed using questionnaires at four waves, which were chosen to represent the different phases of the behaviour-change process.

Baseline measurements (t1) took place in the hospital 2 days post-surgery when participants had received information about pelvic-floor exercise by physiotherapists. Information about and dealing with pelvic-floor exercise is assumed to foster intention formation, thus at t1 patients were assumed to be in the preintentional phase. Patients were recommended not to start exercising as long as they were catheterized. Thus, in the days after surgery and discharge, patients were assumed to prepare for health-behaviour change: They were assumed to be in the preactional phase 2 weeks post-surgery (t2), and to plan how to implement pelvic-floor exercise in their everyday life. One month post-surgery (t3), participants were assumed to have already initiated exercising, that is, they were in the action phase of behaviour change, focussing on behaviour maintenance. Since maintenance over 6 months is difficult and highly prone to relapses, the 6 months post-surgery assessment (t4) represented the recovery phase. Participants were differentiated in maintainers ($n = 71$, 63.4%) and those who recovered after setbacks ($n = 41$, 36.6%).

To test the relative importance of phase-specific self-efficacy beliefs, most were assessed at all times. However, we refrained from assessing preactional self-efficacy at 6 months post-surgery (t4) as patients were expected to have completed the planning phase at this point. Other social-cognitive variables, pelvic-floor exercise, and further indicators of recovery (i.e., catheterization, rehabilitation, and incontinence) were assessed at time points indicated in the section on measures.

Follow-up measurements via mail were completed by 106 individuals at 2 weeks (t2), by 100 individuals at 1 month (t3), and by 94 individuals at 6 months post-surgery (t4), resulting in a total dropout rate of 16%. An institutional review board approved study procedures.

Participants' mean age was 62.8 years ($SD = 6.0$). Patients were married ($n = 102$; 91.1%) or cohabiting ($n = 10$; 8.9%). Only $n = 6$ (5.4%) were divorced and $n = 6$ (5.4%) were widowed. The majority of the patients ($n = 99$; 88.4%) had children. About half of the participants reported less than 12 years of schooling ($n = 42$; 37.5%), the other half ($n = 63$; 56.2%) had 12 or 13 years of schooling. Seven participants did not provide data on their education. Most participants were retired ($n = 61$; 54.5%), the remainder were employed ($n = 39$; 34.8%) or unemployed ($n = 7$; 6.3%). Radical prostatectomy is recommended if the cancer has not metastasized (M0) or spread to lymph nodes (N0). Few patients' tumours ($n = 3$; 2.7%) were classified as not palpable (T1N0M0), most patients' tumours were either palpable ($n = 85$; 75.9%; T2N0M0) or spread through the prostatic capsule ($n = 22$, 19.6%; T3N0M0). All patients underwent radical prostatectomy, and $n = 45$ (40.9%) of them received nerve-sparing surgery.

Measures

Means, standard deviations, Cronbach's alphas, and intercorrelations of the central variables are reported in Table 1.

Task self-efficacy was assessed by three items (e.g., 'I am confident that I can perform pelvic-floor exercise several times a week'; adapted from Scholz *et al.*, 2005). Unless noted otherwise, response options for the social-cognitive variables ranged from 1 (does not apply at all) to 4 (applies exactly).

Preactional self-efficacy was measured with the item stem 'I am confident to start pelvic-floor exercise ...' and three different steps to action, that is, 'even if I have to learn these exercise techniques first', 'even if I have to force myself, to start immediately', and 'even if I have to plan how to implement pelvic-floor exercise in everyday life'.

Maintenance self-efficacy was measured by the item stem 'I am confident to perform pelvic-floor exercise regularly on a long-term basis ...' which was followed by five typical barriers that may hamper behavioural maintenance, for example, 'even if I cannot see any positive changes concerning the incontinence immediately' (adapted from Scholz *et al.*, 2005).

Recovery self-efficacy was measured by the stem 'I am confident that I can return to regular pelvic-floor exercise ...' was followed by three items (e.g., 'even if I have relapsed several times'; adapted from Scholz *et al.*, 2005).

Except for preactional self-efficacy (not assessed at t4), all phase-specific self-efficacy beliefs were assessed at all measurement points in time. Principal components analyses (PCA) with varimax rotation of the 14 self-efficacy items were computed at the four measurement points, extraction criteria were Eigenvalue > 1 or the elbow criterion (Tabachnick & Fidell, 2001). PCAs yielded distinct components with three items for task self-efficacy, three for preactional self-efficacy, five for maintenance self-efficacy, and three for recovery self-efficacy. Looking at all three assessments, between 73% and 82%

Table 1. Central constructs: means (*M*), standard deviations (*SD*), internal consistencies (Cronbach's α), and intercorrelations

Construct	*M*	*SD*	α	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1 risk t1	2.71	0.86	.89	−.20	.28	−.19	.14	−.07	−.11	−.16	−.19	−.16	−.13	−.23	−.10	−.19	−.12	−.15	−.17	.12	−.07	−.09	−.03	.08	.18
2 pout t1	3.83	0.37	.68		−.28	.48	.13	.23	.30	.37	.17	.24	.30	.23	.33	.11	.25	.19	.17	−.06	.01	.10	.09	−.03	−.15
3 nout t1	1.86	0.72	.50			−.18	.02	.01	−.11	−.05	−.19	−.09	−.12	−.18	−.07	−.03	−.14	−.03	−.11	.08	−.12	−.16	−.22	−.02	.15
4 tse t1	3.67	0.49	.85				.30	.47	.61	.56	.29	.47	.36	.36	.25	.30	.29	.22	.12	−.04	.14	.17	.15	−.07	.06
5 pse t1	3.38	0.73	.86					.42	.41	.23	.17	.14	.31	.26	.04	.16	.30	.07	.08	.01	.18	.11	.03	.03	.00
6 mse t1	3.21	0.74	.91						.49	.36	.24	.24	.20	.28	.14	.15	.19	−.01	.01	.04	.14	.19	.05	−.01	.06
7 rse t1	3.55	0.61	.98							.16	.38	.38	.30	.36	.12	.27	.28	.13	.07	.02	.31	.25	.25	.01	.05
8 int t1	3.77	0.46	.88								.14	.41	.24	.22	.22	.37	.25	.11	.12	.17	.22	.12	.08	−.04	.09
9 ap t1	2.41	1.12	.92									.11	.11	.20	.21	.06	.22	.21	.10	−.02	.14	.15	.05	−.03	.02
10 tse t2	3.64	0.50	.80										.34	.29	.41	.67	.49	.32	.05	.01	.10	.08	.16	−.05	.02
11 pse t2	3.29	0.81	.84											.42	.22	.29	.30	.30	.21	.02	−.01	.11	.13	−.02	−.11
12 mse t2	3.27	0.64	.86												.31	.31	.09	−.01	.11	.17	.07	.17	.12	.03	.05
13 rse t2	3.49	0.65	.90													.33	.23	.15	.05	−.01	.01	.03	.11	−.09	−.17
14 int t2	3.69	0.48	.76														.27	.12	.15	−.01	.05	−.03	−.01	−.02	−.06
15 ap t2	3.33	0.86	.85															.33	.17	−.03	.08	.03	.08	.01	−.03
16 pfe t2	143.85	163.92	–																.32	−.17	.04	−.04	−.00	.01	−.11
17 pfe t3	241.57	234.49	–																	.01	−.02	−.10	−.27	.10	−.10
18 iciq t3	13.90	4.76	–																		.08	.05	.02	.24	.50
19 tse t4	3.24	0.78	.90																			.57	.50	.37	.16
20 mse t4	2.28	0.87	.89																				.45	.04	.08
21 rse t4	3.45	0.74	.98																					.14	.11
22 pfe t4	131.48	130.50	–																						.31
23 iciq t4	8.02	5.36	–																						

Note. Coefficients > = |.18| significant at $p < .05$; risk = risk perception; pout/nout = positive/negative outcome expectancies; tse = task self-efficacy; pse = preactional self-efficacy; mse = maintenance self-efficacy; rse = recovery self-efficacy; int = intention; ap = action planning; pfe = pelvic-floor exercise; iciq = incontinence. $N = 112$.

of the total variance was accounted for. PCA thus confirmed discriminant validity of four phase-specific self-efficacy constructs.

Pelvic-floor exercise was assessed at all points in time. At t1, participants additionally indicated whether they had already heard of pelvic-floor exercise prior to surgery and whether they already exercised (0 = no, 1 = yes). Pelvic-floor exercise in minutes per week was assessed by indicating how many days and how many times a day participants had engaged in pelvic-floor exercise in the past week. In addition, they indicated how long they had usually exercised per session (in minutes). Frequencies and average duration per unit were multiplied to obtain a weighted measure of pelvic-floor exercise duration.

Risk perception regarding the development of incontinence symptoms was measured at t1 with three items. The stem 'Compared to other people of your age and gender, how likely do you think it is ...' was followed by different risks such as '... you are incontinent for a long time?' (adapted from Renner *et al.*, 2007 and Schwarzer, 2008). Response options ranged from 1 (extremely unlikely) to 5 (extremely likely).

Positive and negative outcome expectancies were measured at t1 with two items each. The stem 'If I perform pelvic-floor exercise regularly, ...' was followed by consequences such as '... then I can do something about the incontinence' or '... then it reminds me of my disease' adapted from Scholz *et al.* (2005).

Behavioural intentions for regular pelvic-floor exercise were measured at t1 though t4 with three items using the stem 'I intend to ...' which was followed by different levels of pelvic-floor training such as '... perform pelvic-floor exercise several times a week' adapted from Scholz *et al.* (2005).

Action planning concerning pelvic-floor exercise was measured at t2 and t3 with four items adapted from Scholz and colleagues (2005). The stem 'I have made a detailed plan regarding ...' was followed by (1) 'when'; (2) 'where'; (3) 'how'; and (4) 'how often I will perform pelvic-floor exercise'.

Since about half of the patients ($n = 49$; 43.8%) stayed at a rehabilitation clinic at t3 where they were instructed to perform pelvic-floor exercise, *rehabilitation stay* (0 = no, 1 = yes) was considered as a covariate where appropriate.

The *intensity of urinary incontinence* was assessed at t2, t3, and t4 by the German version of the ICIQ-SF (Avery *et al.*, 2004), with scores ranging from 0 (no incontinence) to 21 (severe incontinence). Two patients (1.8%) faced incontinence prior surgery. At t2, 31 patients (27.7%) still had an indwelling *catheter* (0 = no, 1 = yes), which was controlled for where appropriate.

Relapse from regular pelvic-floor exercise was assessed in each questionnaire. An index whether participants had interrupted pelvic-floor exercise due to health-related problems within 6 months post-surgery was used (0 = no, 1 = yes).

Data analysis

To account for missing data, expectation maximization was employed, including all predictors and outcomes, as well as all missing mechanisms in the imputation model (EM; NORM 2.03, Schafer, 1999). Univariate outliers were treated as suggested by Tabachnick and Fidell (2001), that is, cases with standardized scores in excess of 3.29 were reduced to one unit above the next highest value. Multivariate outliers were evaluated by means of Cook's distances. If Cook's distance exceeded 1, they were excluded from the model because of their notable influence on the model (Cook & Weisberg, 1982).

Hierarchical multiple regressions using SPSS 16.0 were performed to test the relative importance and unique predictive validity of phase-specific self-efficacy beliefs as competing predictors. Except for analyses involving correlates of outcomes at 6 months post-surgery (t4), all other analyses related predictors at t-1 with the outcome at t. We refrained from longitudinal analyses predicting outcomes at t4 because of the long inter-measurement lag of 5 months. First, covariates including patients' age, educational level (0 = less than 12 years of schooling, 1 = 12 or 13 years of schooling), nerve-sparing surgery (0 = no, 1 = yes), rehabilitation stay, incontinence or catheterization, and experience of relapses were entered in respective regression models, followed by phase-specific self-efficacy beliefs, and finally by phase-specific social-cognitive variables. For moderation analyses (Aiken & West, 1991), predictor variables and the constituents of the respective interaction terms were centred around their grand means. In moderation models, covariates were entered first, followed by respective self-efficacy beliefs as predictor and phase-indicators as moderator, and finally by the interaction term. To display and test the interaction effects, simple slopes were tested (Preacher, Curran, & Bauer, 2006). Low and high values of the continuous moderators were generated by adding or subtracting one standard deviation from the centred mean of the respective moderator.

Results

Descriptive statistics

The majority of the patients ($n = 82$; 73.2%) had already heard about pelvic-floor exercise, but only 10 patients (8.9%) reported experience with pelvic-floor training pre-surgery. In anticipation of incontinence after surgery, participants were highly motivated to perform pelvic-floor exercise at baseline. Intention levels did not decrease until 6 months later (see Table 1). Two weeks, 1 month, and 6 months post-surgery, 27.7%, 10.7%, and 10.7% of the patients, respectively, did not perform pelvic-floor exercise. The recommendation of at least 3×10 min exercise per day routinely provided by physiotherapists from the Department of Urology was met by 29.5% (t2), 46.4% (t3), and 28.6% (t4) of the participants. Overall, 41 of the participants (36.6%) reported that at some point between discharge and 6 months post-surgery, health-related problems had prevented them from exercising. Regarding the four phase-specific self-efficacy beliefs, patients reported medium to high levels of self-efficacies with means ranging between 2.82 ($SD =$ 0.78) and 3.67 ($SD = 0.49$) (see Table 1). Phase-specific self-efficacies showed cross-sectional intercorrelations between $r = .22$ and $r = .62$, and longitudinal correlations between $r = -.02$ and $r = .48$ (see Table 1). Repeated measures ANOVAs with repeated contrasts revealed that self-efficacies remained at a high level between t1 and t2. From t2 to t4, task self-efficacy and maintenance self-efficacy significantly decreased, whereas recovery self-efficacy did not (task self-efficacy: $F(2, 110) = 13.82, p < .001$; preactional self-efficacy: $F(1, 111) = 1.33$, *n.s.*; maintenance self-efficacy: $F(2, 110) = 12.03$, $p < .001$; recovery self-efficacy: $F(2, 110) = 0.91$, *n.s.*).

Relative importance and unique predictive validity of phase-specific self-efficacy beliefs

Testing hypothesis 1 on the relative importance and unique predictive validity of *task self-efficacy* as a predictor of intentions 2 weeks post-surgery, hierarchical multiple

Table 2. Main-effect analyses on the relative importance of phase-specific self-efficacy beliefs

2A: Main-effect analysis on the relative impact of task self-efficacy predicting intentions 2 weeks post-surgery (t2) (Hypothesis 1)

	Step 1			Step 2			Step 3		
	B	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Age	−0.01	0.01	−.07	−0.01	0.01	−.12	−0.01	0.01	−.09
Education	0.08	0.09	.08	0.14	0.09	.15	0.11	0.09	.12
Nerve-sparing surgery	−0.05	0.10	−.05	−0.09	0.09	−.10	−0.10	0.09	−.11
Catheter t2	0.19	0.10	.18	0.18	0.10	.17	0.22*	0.10	.21
Task self-efficacy t1	–	–	–	0.21	0.11	.22	0.16	0.12	.16
Preactional self-efficacy t1	–	–	–	0.06	0.07	.08	0.07	0.07	.11
Maintenance self-efficacy t1	–	–	–	−0.04	0.07	−.06	−0.06	0.07	−.09
Recovery self-efficacy t1	–	–	–	0.14	0.10	.18	0.13	0.10	.17
Risk perception t1	–	–	–	–	–	–	-0.08	0.06	−.15
Positive outcome-expectancies t1	–	–	–	–	–	–	0.16	0.14	.12
Negative outcome-expectancies t1	–	–	–	–	–	–	0.09	0.07	.13
ΔR^2			.04			.13**			.03

Table 2. *(Continued)*

2B: Main-effect analysis on the relative impact of preactional self-efficacy predicting action planning 2 weeks post-surgery (t2) (Hypothesis 2)

	Step 1			Step 2			Step 3		
	B	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Age	−0.01	0.01	−.04	−0.02	0.01	−.10	−0.02	0.01	−.11
Education	−0.15	0.17	−.08	−0.01	0.16	−.01	−0.02	0.16	−.01
Nerve-sparing surgery	0.20	0.17	.11	0.15	0.16	.09	0.18	0.17	.10
Catheter t2	−0.38*	0.18	−.20	−0.40*	0.17	−.21	−0.42*	0.17	−.22
Task self-efficacy t1	–	–	–	0.30	0.20	.17	0.19	0.22	.11
Preactional self-efficacy t1	–	–	–	0.28*	0.12	.24	0.28*	0.12	.24
Maintenance self-efficacy t1	–	–	–	−0.01	0.13	−.01	−0.02	0.13	−.02
Recovery self-efficacy t1	–	–	–	0.13	0.17	.09	0.09	0.18	.06
Intentions t1	–	–	–	–	–	–	0.27	0.21	.14
ΔR^2			.06			.14**			.01

Table 2. *(Continued)*

2C: Main-effect analysis on the relative impact of maintenance self-efficacy predicting pelvic-floor exercise 1 month post-surgery (t3) (Hypothesis 3)

	Step 1			Step 2			Step 3		
	B	*SE B*	β	*B*	*SE B*	β	*B*	*SE B*	β
Age	−3.37	3.96	−.09	−2.94	3.96	−.08	−2.79	3.94	−.07
Education	−27.54	45.33	−.06	−17.99	45.64	−.04	−14.91	45.39	−.03
Nerve-sparing surgery	−48.29	46.09	−.10	−53.60	46.84	−.11	−60.44	46.75	−.13
Rehabilitation t3	122.99**	45.54	.26	121.59**	45.37	.26	119.32**	45.10	.25
Incontinence t3	−2.50	4.99	−.05	−2.97	5.06	−.06	−2.76	5.03	−.06
Task self-efficacy t2	–	–	–	−14.05	50.10	−.03	−49.54	54.93	−.11
Preactional self-efficacy t2	–	–	–	59.96	30.77	.21	50.26	31.23	.17
Maintenance self-efficacy t2	–	–	–	9.87	39.89	.03	18.70	40.05	.05
Recovery self-efficacy t2	–	–	–	7.13	38.95	.02	5.45	38.72	.02
Action planning t2	–	–	–	–	–	–	45.40	29.73	.17
ΔR^2			.08			.05			.02

Table 2. *(Continued)*

2D: Main-effect analysis on the relative impact of recovery self-efficacy predicting pelvic-floor exercise 6 months post-surgery (t4) (Hypothesis 4)

	Step 1			Step 2		
	B	*SE B*	β	*B*	*SE B*	β
Age	5.08*	2.10	.24	3.78	2.00	.18
Education	22.00	24.26	.08	16.81	22.94	.06
Nerve-sparing surgery	28.19	24.57	.11	22.72	23.81	.09
Incontinence t4	6.18**	2.30	.25	5.38*	2.17	.22
Task self-efficacy t4	–	–	–	75.39***	18.42	.45
Maintenance self-efficacy t4	–	–	–	−33.41*	16.03	−.22
Recovery self-efficacy t4	–	–	–	−8.21	17.95	−.05
ΔR^2			.15**			.12**

Note. *$p < .05$; **$p < .01$; ***$p < .001$. *SE* = standard error. $N = 112$.

regression analysis did not show any unique effect of any phase-specific self-efficacy. Participants who still had an indwelling catheter held higher intentions (see Table 2A).

Findings supported hypothesis 2, in that baseline *preactional self-efficacy* was the strongest predictor of action planning 2 weeks post-surgery. However, participants who still had an indwelling catheter planned less (see Table 2B).

Analyses testing hypothesis 3 revealed that pelvic-floor exercise 1 month post-surgery was neither predicted by *maintenance self-efficacy*, nor by any other phase-specific self-efficacy belief. Attending a rehabilitation programme was related with higher pelvic-floor exercise 1 month post-surgery (see Table 2C).

Due to a long time lag between t3 and t4 of 5 months, we chose to perform cross-sectional analyses predicting pelvic-floor exercise 6 months post-surgery for a test of hypothesis 4. At this time, task self-efficacy was positively and maintenance self-efficacy was negatively associated with pelvic-floor exercise. No main effect for *recovery self-efficacy* was found. Additionally, pelvic-floor exercise was strongly related to incontinence 6 months post-surgery (see Table 2D).

Phase-specificity of self-efficacy beliefs: Exploratory moderation analyses

Exploratory analyses tested differential relations between phase-specific self-efficacy and respective outcomes moderated by indicators of phase-allocation. Predicting action planning 2 days post-surgery, *preactional self-efficacy* and intentions did not interact. Instead, action planning was positively associated with intentions and negatively associated with catheterization (see Table 3A). One multivariate outlier had to be removed from analyses due to high influence on the model.

Considering pelvic-floor exercise at 2 weeks post-surgery as an indicator of allocation to the maintenance phase, neither a moderation effect, nor a main effect of *maintenance self-efficacy* were found. Instead, past behaviour was the best predictor of pelvic-floor exercise 1 month post-surgery (see Table 3B).

At 6 months post-surgery, relapses moderated effects of *recovery self-efficacy* on pelvic-floor training (see Table 3C). Simple slope analyses showed that recovery self-efficacy was associated with returns to pelvic-floor after relapse ($B = 74.06, p < .05$), whereas there was no such association in participants without relapses ($B = -15.41$, *n.s.*). Incontinence and age were positively related to pelvic-floor exercise 6 months post-surgery.

Discussion

Based on phase assumptions of the HAPA model, the present study tested the theoretical differentiation between and relative importance of four phase-specific self-efficacy beliefs in health-behaviour change.

Contrary to predictions and prior findings (Scholz *et al.*, 2005), task self-efficacy immediately following surgery was not uniquely associated with intentional strength 2 weeks later. Next to a fairly high overlap with other phase-specific self-efficacy beliefs, notably, recovery self-efficacy, the lack of unique associations in this analysis may also be due to unstable predictors (Ajzen, 1996) or overstated ratings at baseline. Initially, high levels of motivational predictors and high intentions shortly following the operation might have been adjusted following discharge to be more compatible with patients' everyday life (Sniehotta, Scholz, *et al.*, 2005).

Table 3. Exploratory moderation analyses on the phase-specificity of self-efficacy beliefs

3A: Moderation analysis on preactional self-efficacy by level of intention predicting action planning 2 weeks post-surgery (t2) ($n = 111$)

	Step 1			Step 2		
	B	*SE B*	β	*B*	*SE B*	β
Age	−0.02	0.01	−.11	−0.02	0.01	−.14
Education	−0.23	0.16	−.13	−0.10	0.16	−.06
Nerve-sparing surgery	0.24	0.16	.14	0.25	0.16	.15
Catheter t2	−0.43*	0.17	−.23	−0.43*	0.17	−.23
Preactional self-efficacy t1 (A)	–	–	–	0.20	0.12	.17
Intentions t1 (B)	–	–	–	0.45*	0.19	.23
A × B	–	–	–	0.60	0.35	.18
ΔR^2			.09*			.10**

Table 3. *(Continued)*

3B: Moderation analysis on maintenance self-efficacy by level of past behaviour predicting pelvic-floor exercise 1 month post-surgery (t3)

	Step 1			Step 2		
	B	*SE B*	β	*B*	*SE B*	β
Age	−3.37	3.96	−.09	−2.84	3.80	−.07
Education	−27.54	45.33	−.06	−8.83	43.77	−.02
Nerve-sparing surgery	−48.29	46.09	−.10	−60.57	44.07	−.13
Rehabilitation t3	122.99**	45.54	.26	108.11*	43.74	.23
Incontinence t3	−2.51	5.00	−.05	−0.57	4.96	−.01
Maintenance self-efficacy t2 (A)	–	–	–	37.67	33.85	.10
Pelvic-floor exercise t2 (B)	–	–	–	0.45**	0.13	.31
A × B	–	–	–	0.10	0.20	.05
ΔR^2			.08			.11**

Table 3. *(Continued)*

3C: Moderation analysis on recovery self-efficacy by occurrence of relapse predicting pelvic-floor exercise 6 months post-surgery (t4)

	Step 1			Step 2		
	B	*SE B*	β	*B*	*SE B*	β
Age	5.08*	2.10	.24	4.31*	2.09	.20
Education	22.00	24.26	.08	20.61	23.99	.08
Nerve-sparing surgery	28.19	24.57	.11	22.62	24.89	.09
Incontinence t4	6.18**	2.30	.25	6.14**	2.28	.25
Recovery self-efficacy t4 (A)	–	–	–	29.33	17.56	.17
Lapses (B)	–	–	–	−9.03	23.97	−.03
A × B	–	–	–	93.20*	39.63	.23
ΔR^2			.15**			.05

Note. *$p < .05$; **$p < .01$. *SE* = standard error. $N = 112$.

In the preactional phase, behaviour initiation needs to be planned. Extending previous findings (e.g., Luszczynska & Schwarzer, 2003), our results suggest preactional self-efficacy to be a better predictor for planning than task self-efficacy or any other of the tested phase-specific self-efficacy beliefs. Specifically, the differentiation between task and preactional self-efficacy indicates that different steps towards action (i.e., intention formation and planning), are supported by distinct self-efficacy beliefs. One could argue that a high similarity of predictors and outcomes in terms of context, content, generalizability, and/or salient beliefs (Ajzen, 1996) explain this pattern of effects. In the present study, however, predictors and outcomes differed in terms of measurement context, that is, before and after discharge from the hospital. Moreover, preactional self-efficacy was operationalized as confidence in one's *preparatory actions*, whereas planning is but one aspect of action preparation that also includes learning and self-regulation. Thus, in endorsing preactional self-efficacy items, diverse beliefs are activated which go beyond beliefs associated with action-planning.

Considering intention strength as a moderator did not further qualify this main effect of preactional self-efficacy on action planning. A number of explanations might account for this. As the present sample was fairly small, power problems are a likely explanation for our failure to detect an interaction effect (McClelland & Judd, 1993). Moreover, patients' intentions to perform regular pelvic-floor exercise were almost uniformly high, making detection of a differential prediction difficult.

The assessment 1 month post-surgery was chosen to represent the maintenance phase, assuming that patients have started to exercise their pelvic-floor regularly at this point. In contrast to our hypotheses and findings from previous longitudinal studies (e.g., Luszczynska & Schwarzer, 2003; Schwarzer & Renner, 2000), maintenance self-efficacy 2 weeks post-surgery was neither directly associated with pelvic-floor exercise 1 month post-surgery, nor moderated by past behaviour. As many patients were still catheterized at 2 weeks post-surgery, they might not have had sufficient opportunity to gain maintenance self-efficacy beliefs by mastery experiences (Bandura, 1977). Additionally, participants with long catheterization times might not yet have reached the maintenance phase 1 month post-surgery. Also, context effects might have overruled predictive power of maintenance self-efficacy at this point. Analyses indicated that attending rehabilitation 1 month post-surgery was the strongest predictor of pelvic-floor exercise at that time. Within a structured environment, that is, in the context of a rehabilitation programme, maintenance self-efficacy might lose importance as a predictor of pelvic-floor exercise that is a scheduled part of the programme. The present study thus failed to confirm phase-specific effects of maintenance self-efficacy in persons who already acted.

Investigating the relative importance of phase-specific self-efficacy beliefs with regard to pelvic-floor exercise 6 months post-surgery, unexpectedly, task self-efficacy rather than recovery self-efficacy turned out to be the strongest predictor. One explanation for the missing main effect of recovery self-efficacy might be that 63% of the participants did not report relapses and therefore did not need or build up recovery self-efficacy. We thus also explored the moderating role of prior relapse in the association between recovery self-efficacy and pelvic-floor exercise. In line with previous findings (Scholz *et al.*, 2005), we found that only participants experiencing such relapses benefitted from recovery self-efficacy beliefs in terms of pelvic-floor exercise.

In case of the unexpected main effect of task self-efficacy in the maintenance of pelvic-floor exercise 6 months post-surgery, level of measurement might be addressed as an explanation. In that, task self-efficacy, operationalized as an overall confidence in changing the respective behaviour might reflect a higher order, more conceptional, and less specific measurement approach when compared to other types of phase-specific self-efficacy beliefs tested in this study. Although four types of self-efficacy beliefs were distinguished by means of exploratory principal components analysis with high internal consistencies of the four subscales, indicating satisfying construct validity in the present study, future research should address this issue in more detail.

In contrast to assumptions derived from the HAPA model, maintenance self-efficacy turned out to be negatively associated with pelvic-floor exercise 6 months post-surgery. This conflicts with findings from studies with comparable time frames (Luszczynska & Schwarzer, 2003; Schwarzer & Renner, 2000). Supporting the HAPA assumptions, these studies investigated phase-specific self-efficacy in the context of physical exercise in university students (Rodgers *et al.*, 2002), in patients after myocardial infarction (Scholz *et al.*, 2005), or in women performing breast self-examination (Luszczynska, 2004) that is, health behaviours that have to be maintained for longer time periods to be efficient. Study context may therefore explain why positive associations between maintenance self-efficacy and behaviour were found in these studies, but not in the present study. The need to perform pelvic-floor exercise depends on whether patients still experience incontinence symptoms. As our results show, only participants with stronger incontinence continued to exercise on a high level, whereas those with lower incontinence symptoms exercised less. Thus, participants who already gained maintenance self-efficacy beliefs 1 month post-surgery were able to sustain and then reduce their exercise earlier. Alternatively, the negative association between maintenance self-efficacy and pelvic-floor exercise 6 months post-surgery may be explained by suppressor effects due to strong predictors such as task self-efficacy in the model (Shrout & Bolger, 2002). This result may, however, also raise the theoretical question whether behaviours such as pelvic-floor exercise, which are performed several times a day, still need to be actively 'maintained' or whether they are already habituated and thus do not require maintenance self-efficacy anymore. Future research might focus on processes such as, habituation and disengagement.

Regarding prior evidence of increasing self-efficacy as behaviour change progresses (Sniehotta, Luszczynska, Scholz, & Lippke, 2005), we also found changes, but decreases in task and maintenance self-efficacy beliefs from 1 month to 6 months post-surgery. These led to low longitudinal intercorrelations of self-efficacy beliefs. This might reflect habituation of self-efficacy beliefs throughout the behaviour change progress. Participants might not need to recall them consciously. Moreover, these changes and different predictive patterns of phase-specific self-efficacy beliefs underscore the importance of differentiating between phase-specific confidences in one's capabilities to cope with different challenges during the preparation, implementation, and maintenance of a new health behaviour.

In addition to limitations already discussed, the present findings might be limited by a number of other factors. Behavioural outcomes were assessed by self-reports only, using widely spaced inter-measurement intervals (Schwarz, 1999). While the former may call into question the validity of the assessment of the primary outcome, the latter prevented us from taking a closer look at *processes* of behaviour change. Future work should back up self-reports by objective measures where applicable and use diaries or weekly measurement to capture processes of change. Moreover, the operationalization of phases and the identification of indicators of phase allocation turned out to be very important in this longitudinal design. Future research should investigate additional measurement points following the initiation of behaviour in order to capture stage transitions within short time intervals. Finally, using larger samples, also including female and mixed samples, and investigating different health behaviours, future research should replicate and test generalizability of the present findings.

Concluding, this study investigated phase-specific self-efficacy in the context of uptake and maintenance of pelvic-floor exercise following radical prostatectomy. Although theory assumes specific self-efficacy beliefs for each phase of health-behaviour change (Schwarzer, 2001), the present study failed to fully support these theoretical assumptions. Findings nevertheless supported differentiation between preintentional (i.e., task self-efficacy) and a preactional self-efficacy during early phases of behaviour change. Moreover, the present results stress the importance of considering the occurrence of relapses as a moderator of potential effects of recovery self-efficacy on the maintenance of behaviour change. However, inconsistent findings also draw attention to the need for precise operational definitions of phase-specific self-efficacy beliefs and continued investigation, including experimental manipulation or quasi-experimental work using matched-mismatched designs.

More knowledge on the role of phase-specific self-efficacy beliefs in health-behaviour change might inform further development of tailored interventions. Added intervention strategies could strengthen individuals' specific confidence in their ability to overcome challenges along the way.

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