APPLIED PSYCHOLOGY: HEALTH AND WELL-BEING, 2009, *1* (2), 233–256
doi:10.1111/j.1758-0854.2009.01014.x

Intervention Effects on Cognitive Antecedents of Physical Exercise: A 1-Year Follow-Up Study

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We developed and evaluated a theory-based intervention programme (MoVo-LISA) that encompasses motivational and volitional strategies aiming to prepare orthopaedic rehabilitation patients to perform physical exercise on a regular basis after discharge. The intervention consists of six units: two group sessions, one one-to-one interview, and three after-care contacts. Two hundred and twenty inactive patients were subsequently assigned to an intervention group (standard care plus MoVo-LISA) and a control group (standard care). Participants filled out questionnaires assessing cognitive antecedents of physical exercise. Measurement took place before and after rehabilitation, 6 weeks and 6 months after discharge, and 1 year after discharge. A 2 × 5 repeated measurement design was applied. Results revealed significant main and interaction effects with regard to cognitive variables; the intervention group reported enhanced self-efficacy and more positive balance of outcome expectations at 6 months as well as stronger goal intentions, more elaborated implementation intentions, and optimised strategies of intention shielding at 12 months after discharge compared to patients of the control group. Our findings demonstrate that a short and inexpensive cognitive-behavioural training programme is an effective tool to enable rehabilitation patients to follow treatment recommendations after discharge. The standardised intervention can be conducted by personnel other than psychologists.

Keywords: intervention, motivation, physical exercise, rehabilitation, volition

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INTRODUCTION

Regular physical exercise has the potential to affect people's health condition in many ways. Physical exercise can lower the risk of heart disease, stroke, diabetes, and cancer (colon cancer, breast cancer). It strengthens the immune defence (influenza), reduces the risk of orthopaedic problems (osteoporosis) and the occurrence of pain syndrome (backache). Moreover, physical exercise contributes to positive mental health by reducing depression and anxiety and increasing self-esteem (Baumann, 2004; Oguma & Shinoda-Tagawa, 2004; Vuori, 2004; Warburton, Nicol, & Bredin, 2006).

Although these benefits of regular physical exercise are well documented, only about half of the people who aim to prevent illness as well as those whose health condition is already crippled are able to begin or maintain physical exercise on a regular basis (European Heart Network, 1998; Gauvin, Lévesque, & Richard, 2001; Jackson, Howes, Gupta, Doyle, & Waters, 2005; Livingstone, Robson, Wallace, & McKinley, 2003). This problem of lacking exercise adherence or compliance has been known for a long time (e.g. Oldridge et al., 1983) and has been confirmed already (Buckworth & Dishman, 2002). The process of beginning and maintaining physical exercise has therefore been the subject of intensive research. Theories, particularly from the area of social and health psychology, have been used to explain and predict the setup of a physically active lifestyle (Biddle & Mutrie, 2008; Sallis & Owen, 1999). Regarding these theories, two different lines of research need to be differentiated: *Social Cognition Models* (Theory of Planned Behaviour, Ajzen, 1991; Social-Cognitive Theory, Bandura, 2000; Protection Motivation Theory, Rogers, 1983) as well as *Action Control Theories* (Implementation Intention Approach, Gollwitzer, 1999; Personality Systems Interaction Theory, Kuhl, 2000; Health Action Process Approach, Schwarzer, 2008). While social cognition models (for an overview, see Rutter & Quine, 2002) emphasise more strongly the motivational aspects that lead to the formation of behavioural intentions, action control theories (for an overview, see de Ridder & de Wit, 2006) are more concerned with the volitional (self-regulatory) competencies needed to transform intentions into concrete actions.

MoVo Process Model

The theoretical background in our own research was provided by the MoVo (motivation-volition) process model (Fuchs, 2007). The MoVo process model is an attempt to integrate the most relevant findings from both social cognition models and action control theories. The model does not claim to be a new health behaviour theory; instead, it constitutes a comprehensive summary of those factors and processes that lead to the onset and mainte-

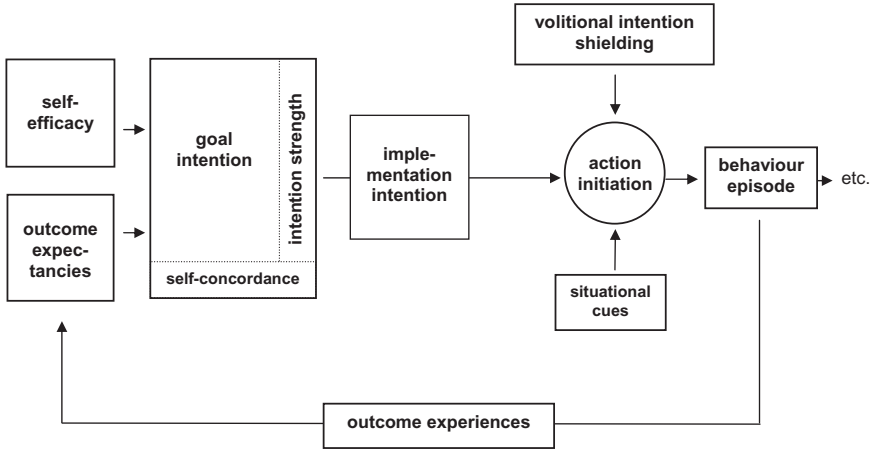

FIGURE 1. MoVo process model.

nance of health behaviour (Figure 1). We will briefly describe the most relevant features of the MoVo process model (for a more detailed description see Fuchs, 2007).

A central construct of the MoVo process model is the *goal intention* with its two aspects: its strength and its self-concordance. The strength of the goal intention is defined as the degree to which someone is ready to perform a specific behaviour, e.g. "I strongly intend to restart playing tennis". According to Gollwitzer (1999), goal intentions have a more general format and do not yet specify the specific features and circumstances of the particular behaviour. Besides its strength, a goal intention is characterised by its self-concordance. Sheldon and Elliot (1998) use this construct to describe the amount to which a goal intention corresponds to personal needs and interests. Self-concordance has high values if a person predominantly strives for internal reasons as opposed to external factors. A meta-analysis by Koestner, Lekes, Powers, and Chicoine (2002) demonstrated that the likelihood of reaching a behavioural goal increases with the degree to which the underlying goal intention is self-concordant.

The MoVo process model states that the chance of developing a strong and self-concordant goal intention depends on outcome expectations and self-efficacy beliefs. *Outcome expectations* (Bandura, 2000) refer to the anticipated consequences of the behaviour (e.g. "When I exercise regularly . . . I can lower my blood pressure"; ". . . the pain in my knee reoccurs"). When positive outcome expectations outweigh negative outcome expectations, strong exercise-related goal intentions have a chance to occur (Williams, Anderson, & Winett, 2005). *Self-efficacy* (Bandura, 2000) refers to the belief that one

feels capable of performing the behaviour in question (e.g. "I am confident that I can still play tennis quite well"). Empirical evidence strongly supports a close link between self-efficacy and goal intentions towards physical exercise (Lippke, Ziegelmann, & Schwarzer, 2004; Scholz, Sniehotta, & Schwarzer, 2005).

Once strong and self-concordant goal intentions are developed, planning competencies need to be applied in order to prepare the actual performance of behaviour. The MoVo process model considers those planning competencies in the form of *implementation intentions* (Gollwitzer, 1999). By forming implementation intentions people specify their intentions by defining when, where, and how they would like to perform the behaviour. Implementation intentions serve to delegate control of behaviour to situational cues. Once the situation arises, performance of behaviour is triggered and released automatically (Gollwitzer & Sheeran, 2006). To date, there is accumulated evidence that people who form specific implementation intentions are more likely to perform physical exercise (Milne, Orbell, & Sheeran, 2002; Sheeran & Silverman, 2003).

Planning is a necessary but not sufficient prerequisite for the onset and maintenance of regular physical exercise. Even well-planned actions are challenged by internal and external barriers (e.g. lethargy, heavy workload at the office). When such barriers occur, various volitional strategies of *intention shielding* should be at a person's disposal to enable them to stick to the intended action, for example positive self-talk, cognitive restructuring, mood management, or stimulus control (Kuhl, 2000). Empirical evidence confirms that such self-regulatory competencies play an important role in the realisation of exercise-related implementation intentions (Sniehotta, Scholz, & Schwarzer, 2005).

Finally, once the intended behaviour has been performed successfully, the MoVo process model postulates a feedback-loop: people evaluate the newly performed behaviour and compare their experiences with the expectations they had before. *Outcome experiences* (Fuchs, 2003) change or confirm the formerly formed outcome expectations and thus modify or maintain a person's future goal intentions (cf. Rothman's [2000, p. 64] concept of "perceived satisfaction with received outcomes").

MoVo Intervention

Based on the MoVo process model, an intervention programme was designed in order to help participants set up a physically active lifestyle. The MoVo intervention programme consists of motivational as well as volitional strategies of behaviour modification (cf. Milne et al., 2002). *Motivational strategies* aim at the creation of strong and self-concordant goal intentions.

They encompass the following approaches: (a) clarification of personal health objectives ("goal setting"; Locke & Latham, 1990); (b) contemplation of different actions to achieve these health objectives ("decisional balance sheet"; Miller & Rollnick, 2002); (c) formation of strong goal intentions ("decision-making approach"; Holtgrave, Tinsley, & Kay, 1995); and (d) checking self-concordance of these goal intentions ("self-generated goals"; Sheldon & Elliot, 1998). The *volitional strategies* targeting implementation competencies and action control abilities encompass the following approaches: (a) generating implementation intentions ("when-where-and-how plans"; Prestwich, Lawton, & Conner, 2003); (b) anticipating the personal barriers ("perceived internal and external barriers"; Sniehotta, Nagy, Scholz, & Schwarzer, 2006); (c) developing counter strategies ("barrier management"; Conn, Hafdahl, Brown, & Brown, 2008); and finally (d) self-monitoring the new behaviour ("behavioural protocols"; Aittasalo, Miilunpalo, Kukkonen-Harjula, & Pasanen, 2006).

There are specific versions of the MoVo intervention programme for different settings and target groups (overweight groups and members of health insurance; in-patient rehabilitation and open setting). The version that was applied in the current research is called MoVo-LISA (LISA stands for "Lifestyle-Integrated Sport Activity"). It was developed for an in-patient orthopaedic rehabilitation setting and applied with groups of six people. The special needs of such clientele and of the in-patient setting were considered, as described in the method section.

Research Hypothesis

In order to attain enduring behaviour modification it is necessary to change the underlying cognitions and self-regulatory skills. The cognitive variables at the focus of the MoVo-LISA intervention were provided by the MoVo process model. The present research was guided by the following *research hypothesis*: Participants who undergo the MoVo-LISA programme (intervention group) will show (a) higher self-efficacy beliefs, (b) more positive balance of outcome expectations, (c) stronger and (d) more self-concordant goal intentions, (e) more elaborated implementation intentions, and (f) optimised strategies of intention shielding at the follow-ups (6 weeks, 6 months, and 12 months) than patients who did not participate in the intervention programme (control group). Results regarding the effects of MoVo-LISA on behaviour (level of physical exercise per week) are the subject of another paper and will only briefly be reported here (Fuchs, Göhner, & Seelig, under review). However, for the present research it is important to know that there were clear and significant intervention effects on behavioural outcome variables even 12 months after the end of the programme.

METHOD

Participants

The target sample were people who were registered for a 3-week in-patient rehabilitation programme in a clinic in Southern Germany because of chronic orthopaedic conditions (e.g. arthritis, chronic back pain, etc.). Only those patients were included in the study who indicated that they had not participated in any regular physical exercise during the last few weeks (0 minutes physical exercise per week). By applying this strict selection criterion we allocated the limited resources that we had to conduct the MoVo-LISA intervention with specifically trained clinic personnel to the most inactive patients: MoVo-LISA could be offered to only 12 participants per week. Before they came into the clinic, all patients gave informed consent to participate in the study.

Sample Flow and Dropout

Of the 1,720 invited patients, $n = 1{,}113$ agreed to participate in the study and filled out the first questionnaire (intervention sample: $n = 432$, control sample: $n = 681$). From the $n = 432$ persons in the *intervention sample*, $n = 151$ met the inclusion criteria (chronic orthopaedic condition and physical inactivity) and were therefore eligible for participating in the study and the intervention programme. Of those, $n = 15$ patients did not complete the intervention programme (due to interference with other therapeutic activities), resulting in $n = 136$ patients in the intervention group. Of those, $n = 132$ filled out the second questionnaire, $n = 122$ the third, $n = 103$ the fourth, and $n = 105$ filled out the fifth questionnaire. In the *control sample*, of the $n = 681$ participating patients $n = 252$ persons met the inclusion criteria and were therefore eligible to take part in the study. Of those, $n = 215$ filled out the second questionnaire. The third questionnaire was completed by $n = 179$ patients, the fourth by $n = 156$ patients, and the fifth by $n = 155$ patients. In both samples, the third, fourth, and fifth questionnaires were each sent out to all patients who had completed the second questionnaire. Yet, the analyses reported in this paper are based on the *longitudinal sample* ($N = 220$) of the intervention group ($n = 88$) and the control group ($n = 132$), in which complete data on all five measurements with regard to the variable physical exercise were available.

Sample Description

The longitudinal sample ($N = 220$) was between 30 and 64 years old, and the average age was 51.08 years ($SD = 6.93$). Of the 220 participants, 57 per cent

were female, and 18 per cent lived alone. The majority had completed basic secondary and middle-level secondary school (respectively 51% and 25%), whereas 15 per cent were eligible for university or completed university. Having no degree or other qualification was reported by 2 per cent and 7 per cent, respectively. A majority of the participants (69%) worked full time, 24 per cent worked part time, and 7 per cent were currently unemployed. About half of the sample had participated in at least one in-patient rehabilitation programme before (45%). With regard to socio-demographic characteristics, there were no significant differences between the intervention group and the control group except for age (intervention group: $M = 52.3$ years, $SD = 6.3$; control group: $M = 50.2$, $SD = 7.2$; $p = .03$).

Study Design and Procedure

All participants received the 3-week standard rehabilitation programme of the study clinic. Patients in the intervention group additionally participated in the MoVo-LISA intervention programme that consisted of six modules (Figure 2: intervention design): (1) first group meeting, scheduled for 60 minutes in the second week of the 3-week clinic stay, (2) one-to-one interview, scheduled for 10 minutes per patient on the penultimate day before discharge, (3) second group meeting, scheduled for 90 minutes on the very last day of the clinic stay, (4) postal reminder, sent out 3 weeks after discharge, (5) telephone call, scheduled for 10 minutes, 6 weeks after discharge. The last module was (6) self-monitoring over the time period of 6 weeks after discharge.

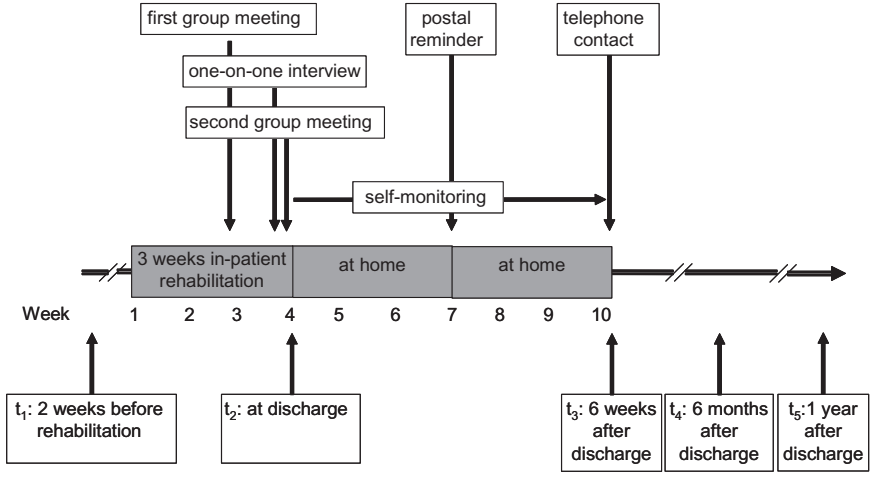

FIGURE 2. Intervention design (above arrow) and study design (below arrow).

Questionnaires were filled out by both groups at five time points (Figure 2: study design): Two weeks before the start of the clinic stay (Time 1; t1), at the end of the clinic stay (Time 2; t2), 6 weeks after discharge from the clinic (Time 3; t3), 6 months after discharge (Time 4; t4), and 12 months after discharge (Time 5, t5). All questionnaires except the second, that was distributed and collected within the clinic, were mailed to participants' home address. Since MoVo-LISA was implemented in the clinic only after the discharge of all patients in the control group, there were no ethical concerns on the part of the German Pension Insurance Company with regard to the control group. Furthermore, data security was guaranteed by the authorised person of the German Pension Insurance Company.

Intervention

The content as well as the didactic procedures of MoVo-LISA are standardised and published (Göhner & Fuchs, 2007). Because of the high level of standardisation, MoVo-LISA was applied by trained clinic personnel who were not only psychologists: during a two-day seminar, four physiotherapists and one psychologist received information about the theoretical background and were trained in the use of role play in the application of the programme.

The *first group meeting* took place only at the end of the second week of the 3-week clinic stay. Within the first 2 weeks patients were introduced to the usual physical exercise programme of the clinic (e.g. swimming, Nordic Walking) as well as standard physiotherapeutic treatment. Both were assumed to lead to positive outcome experiences as well as favourable self-efficacy beliefs regarding physical exercise. The first group meeting then started with clarifying personal health goals. In the next step, patients defined what kind of physical exercise they would be ready to undertake in order to attain their health goals. For this purpose, patients were asked to collect several activity ideas, e.g. activities such as Nordic Walking or swimming, in which they could see themselves taking part. From those activity ideas, patients finally chose their favourite physical exercise—ideally, they chose the idea that they imagined they could implement into their daily routine in the long term. Afterwards, patients were asked to think about a detailed exercise plan for the time after discharge that would enable them to reach their personal health goals. The plan had to meet several criteria: the plan had to be personal (referring to self-concordance), the plan had to be practical (work within daily activities), the plan had to be precise with regard to time, place, sport-partner, and occasion (referring to implementation intentions), and the plan had to be effective with regard to the individual health problem. During the *one-to-one interview*—that was scheduled only 1 week later, allowing patients to take enough time to think about and to develop such a detailed plan—those individual plans were discussed in detail: the moderator helped

each patient by exploring the most fitting exercise plan, and in addition critically questioned whether the exercise plan of each patient was really cast-iron. In the *second group meeting*, anticipation of internal and external barriers (i.e. being tired, not having enough time), as well as the management of those barriers by applying volitional strategies of intention shielding, was discussed. The reason for scheduling this group meeting on the very last day of the clinic stay was to facilitate anticipation of daily barriers at home through the proximity to discharge and to let patients have their "last action" within the clinic focus on the topic of how to maintain physical exercise.

During the first 6 weeks after discharge, patients were asked to *self-monitor* their exercise behaviour by filling out a simple action protocol. To support patients and to deepen commitment during this time which is supposed to be a crucial time point in implementing physical exercise, the last two components of MoVo-LISA were conducted: a minimal *postal reminder* where the content of MoVo-LISA was briefly repeated as well as the short telephone contact 3 and 6 weeks after discharge, respectively. During the *telephone contact*, the moderator asked about the state of affairs regarding the personal exercise plans and their realisation, encouraged the participants to stay active and discussed possible changes of the plan together with the patient in case they did not work well.

Measures

All questionnaires contained measures of the selected psychological variables (self-efficacy, outcome expectations, strength and self-concordance of goal intentions, implementation intentions, perceived barriers, intention shielding strategies) and behavioural variables (level of physical exercise). The first questionnaire also asked for demographic details.

Self-efficacy refers to people's belief in their capability to perform a given behaviour successfully (Bandura, 1986). In accordance with Schwarzer and colleagues (Luszczynska & Schwarzer, 2003; Schwarzer & Renner, 2000; Sniehotta et al., 2005), we assessed three different scopes of self-efficacy: the belief that they were able to begin regular physical exercise ("I am capable of beginning with regular physical exercise"), the belief that they were able to maintain regular activity over a longer time period, and the belief that they were able to resume regular activity after interruption (e.g. because of illness, vacation, or moving house). Each scope of self-efficacy was measured with one item; the scores of the three items were combined into one mean value on the variable "self-efficacy". The response format was a 6-point Likert-scale ranging from 0 = "I don't feel capable at all" to 5 = "I feel 100 per cent capable". Descriptive statistics for the variable "self-efficacy" at t1 were: $M = 3.33$; $SE = 0.09$; $SD = 1.27$; median = 3.33; skewness = –0.55; excess = –0.32; range = 0 to 5.

Outcome expectations refer to the anticipated consequences that will result from the given behaviour (Bandura, 1986). In accordance with Fuchs (Fuchs, 1994), we assessed nine *positive* and seven *negative outcome expectations* regarding physical exercise. All items were launched with "If I were physically active on a regular basis . . . " and followed by statements like ". . . I would feel better" (positive) or ". . . I could hurt myself" (negative). The response format was a 4-point Likert-scale ranging from 1 = "I do not agree" to 4 = "I strongly agree". The positive and negative outcome expectations were each summarised into subindices. In order to create a general index "outcome expectations"—reflecting the balance of positive and negative expectations—the subindex of negative outcome expectations was subtracted from the subindex of positive outcome expectations. Descriptive statistics for the index "outcome expectations" at t1 were: $M = 1.27$; $SE = 0.05$; $SD = 0.77$; median = 1.32; skewness = –0.43; excess = 0.08; range = –1.41 to 2.86.

Strength of goal intention was assessed with one item: "How strong is your intention to exercise regularly within the following weeks and months?" Response format was a 6-point Likert-scale ranging from 0 ("I don't have this intention at all") to 5 ("I do have a strong intention"). Descriptive statistics for the variable "strength of goal intention" at t1 were: $M = 3.08$; $SE = 0.10$; $SD = 1.54$; median = 3.00; skewness = –0.54; excess = –0.55.

S*elf-concordance* of the goal intention was measured by the SSK scale, a German-language 12-item instrument that has proven to be a reliable and valid measure of exercise-related goal self-concordance (Seelig & Fuchs, 2006). In line with the self-concordance model of Sheldon and Elliot (1999), the SSK scale consisted of four subscales that measured the *intrinsic*, *identified*, *introjected*, or *extrinsic* motivation of being physically active. Each subscale was formed by three items. The items were launched with: "I intend to exercise regularly within the following weeks and months because . . . " and were followed by statements like ". . . it's just fun for me" (*intrinsic*), ". . . I have good reasons to be active" (*identified*), ". . . otherwise I would have a guilty conscience" (*introjected*), and ". . . others tell me to become physically active" (*extrinsic*). Participants who indicated having at least a weak exercise-related goal intention (strength of goal intention ≥ 1) were asked to respond on a 4-point Likert-scale ranging from 1 ("not true") to 4 ("true"). Those who reported no intention to exercise were asked to skip this part of the questionnaire (number of "non-intenders" at Time 1 to Time 5 was: $n = 22, 2, 5, 12, 14$, respectively). Cronbach's alpha at Time 1 ranged from $\alpha = .67$ (introjected) to $\alpha = .76$ (extrinsic). A general index "self-concordance" was formed by summing up the identified and intrinsic means scores and subtracting the introjected and extrinsic means scores (cf. Sheldon & Elliot, 1999). Descriptive statistics for the index "self-concordance" at t1 were: $M = 1.95$; $SE = 0.10$; $SD = 1.41$; median = 2.00; skewness = –0.27; excess = –0.51; range = –1.67 to 5.33.

Implementation intentions: Patients were asked whether they already knew which physical exercise they would perform in the following weeks and months. If they answered "yes", patients were asked to note this activity. An opportunity was provided to name a second activity. Subsequently, for each of these activities participants were asked whether they already knew when and where they would perform it, how they would get there, how often and with whom they would perform it. A score for the implementation intentions was formed by summing up the number of positive answers (including naming the activity plus planning details). Descriptive statistics for the summary variable "implementation intention" at t1 were: $M = 3.43$; $SE = 0.29$; $SD = 4.28$; median = 0.00; skewness = 0.82; excess = –0.77; range = 0 to 12.

The index *Volitional Intention Shielding* (VIS-index) consisted of two components: the subindices "Perceived Barriers" and "Counter Strategies". The subindex *Perceived Barriers* was based on the question: "How strongly do the following barriers keep you from exercising?" A list of 19 possible barriers was presented (e.g. the weather is bad; there is a lot of work to do; etc.). Responses were given on a 4-point scale ranging from 1 ("not at all") to 4 ("very much"). The subindex Perceived Barriers was the mean of the 19 scores; it indicates the level of perceived barriers with regard to physical exercise. After filling out the list of barriers, participants were asked for their counter-strategies: "What do you do in order to overcome the barriers just mentioned?" The subindex *Counter Strategies* was based on a list of 15 possible ways to manage those barriers. Typical items are: "I make an appointment with a friend to exercise together"; "I avoid situations that could keep me from exercising (e.g. switching on the TV)", etc. Response format was dichotomous: "Yes, I use this strategy" (= 1) or "No, I don't use this strategy" (= 0). The subindex Counter Strategies was the mean of the 15 scores; it indicated the number of counter-strategies used. Finally, the *VIS-index* was created from the quotient of the subindex Counter Strategies and the subindex Perceived Barriers (range 0–1). Thus, a high score on the VIS-index indicated a favourable ratio of available counter-strategies and perceived barriers. The higher the VIS-index, the more successful was the intention shielding with regard to the planned physical activities. Descriptive statistics for the VIS-Index at t1 were: $M = 0.23$; $SE = 0.01$; $SD = 0.13$; median = 0.23; skewness = 0.43; excess = 0.75.

RESULTS

We conducted analyses of covariance for repeated measures (t1 to t5) with the given psychological factors (self-efficacy, outcome expectations, strength of goal intention, self-concordance, implementation intention, or volitional intention shielding) as dependent variable, group (intervention vs. control

condition) as independent variable, and sex and age as covariates. Exact results are reported in Table 1. There were no significant differences in any of the MoVo process model variables between the two groups at Time 1. The *intervention effect* was indicated by the interaction term "group by time" for the time interval t1 to t3 (at t2 the intervention had not yet finished; t2 was therefore not considered in this analysis). The *maintenance of the intervention effect* was indicated by the main effect of the "group" variable at t3, t4, and t5. Figure 3 graphically displays the age- and sex-adjusted means of the psychological variables.

Results revealed a significant intervention effect on the variable *self-efficacy*. Both groups started at almost identical middle levels of self-efficacy at t1 and seemed to profit substantially from the exercise-therapeutic programmes at the clinic, resulting in higher levels of self-efficacy at t2. However, the increase in self-efficacy was significantly stronger in the intervention group than in the control group. From t2 to t5 the level of self-efficacy decreased in both groups. At t3 and t4 the group differences were still significant, and at t5 this was no longer the case.

Figure 3 also revealed a significant intervention effect on the balance between positive and negative *outcome expectations*. At t1, although slightly drifting apart, the means on the index were not significantly different in the intervention and control groups. Six weeks after the clinic stay (t3) the difference between both groups reached its maximum. Afterwards there was a slight tendency in both groups towards a more negative balance. At t3 and t4 the group differences were still significant, and at t5 this difference wore off.

Analyses of variance revealed a strong interaction effect "group by time" for the variable *strength of goal intention* ($F = 10.29$; $p = .002$). Both groups indicated similar values at t1, followed by a marked increase of values over the course of the clinic (t2). Again, this increase was stronger in the intervention than the control group, resulting in a significant group difference at t2. Whereas values of the control group decreased down to the initial level over the next 6 months (t4), values of the intervention group decreased merely to the t2 level of the control group. At t5 the group differences were still significant.

The results revealed no significant interaction and group effects for the variable *self-concordance*. However, as depicted in Figure 3d, the pattern of means over the five points of measurement is similar to the pattern that we found for the other five variables. Starting at comparable levels of self-concordance (t1), both groups showed increased values at t2 with a stronger increase in the intervention group, but only at a 10 per cent level of significance. Interestingly, both groups stabilised the level of self-concordance over the next three measurements (t3 to t5).

Again a significant intervention effect could be observed for the variable *implementation intention*. Starting with no elaborated plans about physical

TABLE 1
Adjusted Means (age, sex) and Standard Errors for Intervention and Control Group. Interaction and Group Effects (MANOVA)

		Means (M) and standard errors (SE) at the time points t1 to t5					*Intervention effect (interaction effect "group × time" with data from t1 and t3)*				*Maintenance of intervention effect (main effect "group" with data from t3, t4, t5)*			
		t1	*t2*	*t3*	*t4*	*t5*								
Variable		M (SE)	M (SE)	M (SE)	M (SE)	M (SE)	F (group by time)	*df*	p	*Eta*^{2}	F (group)	*df*	p	*Eta*^{2}
Self-efficacy	CG	3.33 (.12)	3.86 (.09)	3.66 (.09)	3.29 (.11)	3.45 (.12)	6.51	1,193	.011	.033	9.35	1,197	.003	.045
	IG	3.32 (.12)	4.12 (.15)	4.05 (.11)	3.89 (.12)	3.66 (.14)								
Test of significance[1)]		ns	*	*	**	ns								
balance index of outcome expectations	CG	1.26 (.07)	1.50 (.06)	1.48 (.07)	1.36 (.07)	1.41 (.07)	4.14	1,211	.043	.019	5.61	1,207	.019	.026
	IG	1.33 (.07)	1.72 (.08)	1.74 (.08)	1.62 (.08)	1.56 (.08)								
Test of significance		ns	*	*	*	ns								
strength of goal intention	CG	3.10 (.14)	4.03 (.08)	3.70 (.10)	3.07 (.13)	3.23 (.14)	10.29	1,211	.002	.046	16.43	1,200	<.001	.076
	IG	3.23 (.14)	3.12 (.17)	4.49 (.10)	4.32 (.12)	3.95 (.15)								
Test of significance		ns	**	**	**	*								
self-concordance index	CG	2.01 (.14)	2.59 (.14)	2.81 (.14)	2.62 (.15)	2.70 (.14)	2.14	1,190	.141	.011	1.88	1,184	.172	.010
	IG	2.05 (.14)	2.96 (.17)	3.07 (.17)	3.00 (.17)	3.02 (.18)								

TABLE 1
Continued.

		Means (M) and standard errors (SE) at the time points t1 to t5					*Intervention effect (interaction effect "group × time" with data from t1 and t3)*				*Maintenance of intervention effect (main effect "group" with data from t3, t4, t5)*			
		t1	*t2*	*t3*	*t4*	*t5*								
Variable		M (SE)	M (SE)	M (SE)	M (SE)	M (SE)	F (group by time)	*df*	p	*Eta*^{2}	F (group)	*df*	p	*Eta*^{2}
Test of significance		ns	ns	ns	ns	ns								
implementation intentions	CG	3.36	7.78	6.91	5.27	6.01	4.31	1,205	.039	.021	23.91	1,202	<.001	.106
		(.40)	(.34)	(.40)	(.42)	(.42)								
	IG	3.81	10.12	8.86	8.89	8.22								
		(.42)	(.48)	(.41)	(.48)	(.50)								
Test of significance		ns	**	**	**	**								
volitional intention shielding index	CG	.23	.30	.27	.26	.26	16.31	1,207	<.001	.073	19.384	1,202	<.001	.088
		(.01)	(.01)	(.01)	(.01)	(.02)								
	IG	.23	.38	.36	.35	.33								
		(.02)	(.01)	(.01)	(.02)	(.02)								
Test of significance		ns	**	**	**	**								

[1)] Between groups at the given time point; * $p < .05$, ** $p < .01$; CG: control group; IG: intervention group.

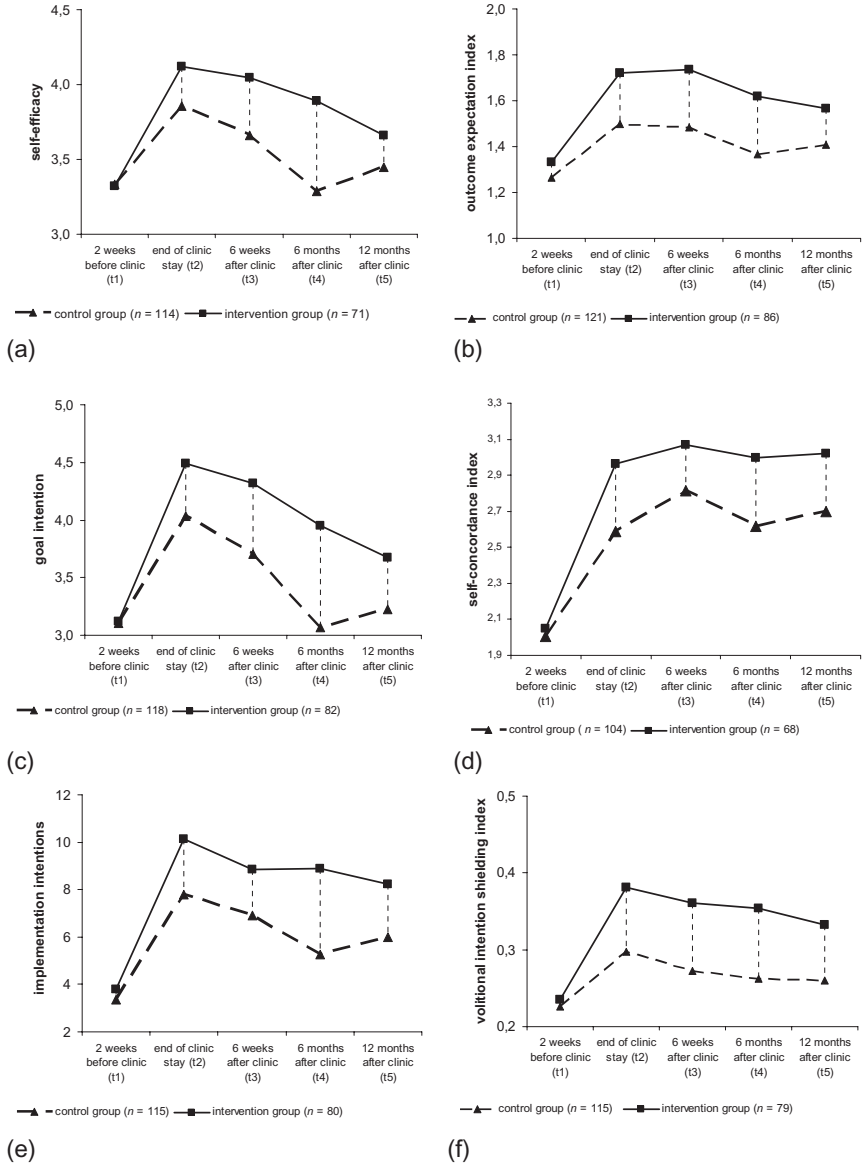

FIGURE 3. Means of (a) self-efficacy, (b) outcome expectation index, (c) strength of goal intention, (d) self-concordance index, (e) implementation intentions, and (f) volitional intention shielding index. Values are adjusted for sex and age.

exercise at t1, both groups indicated having significantly more detailed plans at t2, with the intervention group exceeding the control group once more (significant group difference at t2). This group difference was maintained over the next 12 months, although in both groups the means decreased slightly with time.

A strong intervention effect was obtained for the variable *volitional intention shielding* ($F = 16.31$; $p < .001$). After starting with almost identical levels at t1, the group difference at t2 was highly significant ($p < .01$). Thereafter, values of both groups decreased slightly but analogically over the following 12 months, showing significant differences even at t5.

In summary, most of our research hypotheses could be confirmed: Participants who underwent the MoVo-LISA intervention showed enhanced self-efficacy, a more positive balance of outcome expectations, stronger goal intentions, more detailed implementation intentions, and an optimised ratio of intention shielding strategies and perceived barriers in the weeks and months after intervention compared to persons who did not receive this intervention. Regarding the variable "self-concordance", intervention effects did not reach the level of statistical significance. Intent-to-treat analyses using the last observation carry-forward method (Shao & Zhong, 2003) confirmed the pattern of findings reported here.

Besides these main results two special features of the findings deserve to be highlighted for the discussion: (1) the t1 means of all psychological variables were almost identical in the intervention and control groups, indicating a good comparability of both groups; (2) among five of the six psychological variables there was a relatively strong decrease from t3 to t4 followed by a slight re-increase from t4 to t5 only in the control group. Additional in-depth analyses did not lead to any plausible explanation for this "dent" at t4.

DISCUSSION

The purpose of this study was to evaluate the effects of a theory-based, standardised group intervention programme (MoVo-LISA) on specific psychological factors assumed to control the setup and maintenance of regular physical exercise. The effects of this programme on behaviour itself (physical exercise) are a subject of thier own and will be reported in a separate publication (Fuchs et al., under review). To adequately evaluate the psychological effects of MoVo-LISA reported in the current paper, it is necessary to know that MoVo-LISA also led to substantial and long-term behaviour changes: 12 months after discharge, the intervention group was on average 28 minutes per week more active than the control group (intervention group: 96 minutes, control group: 68 minutes, ($F[1, 218] = 3.9$, $p = .05$). Stated in terms of prevalence: 12 months after discharge 50 per cent of the intervention group

were active for at least one hour per week—but only 33 per cent of the control group were ($p = .01$).

Results reported in the present paper suggest that these behaviour changes are based on changes in the underlying psychological factors. Using the MoVo process model (Figure 1) as the theoretical framework we looked at six variables: self-efficacy, outcome expectations, strength and self-concordance of goal intention, implementation intention, and volitional intention shielding. Except for self-concordance, all variables showed significant intervention effects (significant "group by time" interaction term from t1 to t3) (Table 1). Moreover, these intervention effects could be well maintained over the next 10.5 months (t3 to t5): although the differences between the intervention and control groups diminished over time they remained clearly identifiable on the descriptive level (Figure 3) and were still significant in five variables at t4 (6-month follow-up) and in three variables at t5 (12-month follow-up) (Table 1). The pattern of results for "self-concordance" was not principally different from the other psychological factors; however, neither the intervention effect ($p = .14$) nor the group difference t3 to t5 ($p = .17$) reached statistical significance. Taken together, the findings confirm our research hypothesis that MoVo-LISA has the potential to evoke enduring changes in those cognitions that are hypothesised to be responsible for onset and continuation of regular physical exercise. Here, we look at some important findings in more detail:

(1) On all psychological variables, values increased from t1 to t2 not only in the intervention group but also in the control group (usual care), confirming the high quality of the standard rehabilitation programme in the study clinic. However, the values of the control group did not increase as much as the values of the intervention group, leading to the significant intervention effects observed at t3 (at the end of all intervention activities). Afterwards, values in both groups decreased again (exception: self-concordance) with the difference between both groups remaining relatively stable. Obviously, MoVo-LISA serves as a kind of "launch pad": the programme is able to evoke a critical difference between both groups at t3 (6 weeks after discharge) which can be maintained over the next 10.5 months.
(2) The strongest *intervention effect* was found for the variable "volitional intention shielding" ($eta^2 = .073$; see Table 1), reflecting the fact that a considerable amount of time during the second group session was devoted to the identification of personal barriers that impede realisation of one's activity plans and to discussing possible counter-strategies to overcome these barriers (barrier management). Interestingly, the intervention effect for "volitional intention shielding" can be relatively well maintained until the 12-month follow-up

(eta^2 = .088; see Table 1: *maintenance of intervention effect*), suggesting that MoVo-LISA may have instigated a continuing learning process with regard to self-control and self-regulation of physical exercise (Kuhl, 2000).

(3) Besides barrier management, the focus of MoVo-LISA was also on the formation of precise and realistic implementation intentions ("planning intervention"; Sniehotta et al., 2005, 2006). Although for the variable "implementation intentions" the intervention effect (eta^2 = .021) was not as pronounced as for other variables, it had the best maintenance score of all variables (eta^2 = .106). Thus, the intervention may have evoked not a strong, but a long-lasting change on the level of implementation intentions, a factor that is known to be of high relevance to setting up a physically active lifestyle (Lippke et al., 2004).

(4) The results concerning self-concordance are less definite. First of all, it needs to be highlighted that self-concordance is the only variable where for both groups (intervention and control group)—although on different levels—there is no decline of values from t2 to t5 (Figure 3d). Obviously, the stay at the clinic led to a lasting change of the self-concordance of goal intentions in both groups. People form intentions with regard to physical exercise that are closer to their needs and preferences and that are a better fit to their personal way of life. As mentioned above, the difference between both groups is not significant. However, in-depth analyses—not reported in this paper—show that the four components of the self-concordance index react differently to the intervention: for the subscales "intrinsic motivation" and "identified motivation" significant and strong intervention effects could be identified ($p < .001$); however, scores on the subscales "introjected motivation" and "external motivation" were not affected by MoVo-LISA. Further analyses need to clarify the specific mechanism underlying the general construct of self-concordance.

Limitations

Although we know that MoVo-LISA was effective, we must say that the actual design does not allow filtering which part of the intervention counted for how much effectiveness. Was it the clear task to make detailed plans about physical exercise? Was it the one-to-one interview, where patients' plans were critically questioned and therefore became quite realistic plans? Or was it elaborating barriers that might hinder those plans? We applied a broad combination of intervention techniques, where some of those might be ideal techniques for one patient, but not for another patient.

Additionally, our design did not allow a randomisation procedure, i.e. factors other than the treatment could account for the difference in groups. MoVo-LISA was implemented throughout the clinic; all medical personnel played a specific role within this programme. If we had implemented MoVo-LISA at the same time as we collected data from the control group, patients would have had informal talks and exchanged information about the programme. Also, medical personnel would not have been neutral with regard to the control group. Therefore, we chose a sequential control group design, where we collected data from the intervention group only after the patients in the control group had left the clinic (quasi-experimental design). This procedure might have produced another problem: patients' discharge from the clinic took place during different seasons that could have influenced their physical exercise behaviour over the follow-up time period. One would assume that warm summertime might be more stimulating for physical exercise than cold and rainy winter days, for example. Still, we could not find any evidence for this assumption, there was no enhanced summer activity in either of the groups. Furthermore, we cannot discount concerns about socially desirable answers of participants in the intervention group. Especially with the one-to-one interview in mind, where one reason for the interview is enhanced commitment, we cannot completely rule out the possibility that patients in the intervention group may have indicated "better values" only to meet the expectations of the moderator. Lastly, we did not address behaviour in the present paper; the focus of the current paper was on cognitive antecedents of physical exercise. In line with this we cannot say that the MoVo process model has been tested, and this was not the purpose of the paper. The MoVo process model was used to specify critical parameters of the intervention; but the overall mediator model has not been specified to test the theory.

Conclusions

We conclude that standard rehabilitation (normal care) does have substantial effects on the measured variables; however, normal care complemented with MoVo-LISA outweighs those effects and evokes initial and partly long-term effects on motivational as well as volitional variables. Additional features support the usefulness of this programme: (a) In their review Hillsdon, Foster, and Thorogood (2005) criticise the lack of or insufficient theoretical underpinning of many intervention programmes to improve physical exercise. The theoretical background of the present intervention was provided by the MoVo process model which tries to integrate the most important features of current social-cognitive theories (Ajzen, 1991; Bandura, 2000) and volitional action theories (Gollwitzer, 1999; Kuhl, 2000; Schwarzer, 2008). The MoVo process model was used to specify those cognitions that need to be

targeted by the intervention programme. Additionally, the targeted cognitions were specific to the type of exercise patients engaged in (cf. Rodgers, Murray, Courneya, Bell, & Harber, 2009). (b) The intervention programme presented in this paper is a standardised, published curriculum, allowing us to multiply the intervention (Göhner & Fuchs, 2007). Professionals are invited to apply the programme without further training; personnel who are not directly involved into the motivation-volition topic (as our moderators were, namely the physiotherapists) need a short training seminar to introduce the theoretical background and to call attention to crucial paragraphs within the curriculum (for example, the one-to-one-interview). Furthermore, standardisation of the intervention course allows us to further test the effectiveness of the intervention. (c) MoVo-LISA is cost-efficient: clinic personnel (psychologists, physiotherapists) could implement MoVo-LISA with comparatively little preparation. The programme requires financial coverage with regard to material and labour costs. While developing the programme we anticipated such costs and kept the duration of MoVo-LISA on an optimal scale, the content as detailed as necessary and as short as possible; likewise we kept material as simple and as minimal as possible.

Practical and Future Implications

MoVo-LISA has the potential to enable rehabilitation patients to become regular exercisers after discharge. Moreover, the intervention is short and concise enough to have a chance of being realised as part of standard rehabilitation care (as planned in clinics of the German Pension Insurance). Particularly favourable is the fact that MoVo-LISA uses the time-frame of in-patient rehabilitation in order to influence the time period after discharge. Thus, all patients are reached and this leads to high external validity. Further considerations should focus on two areas: One can question whether the booster intervention after discharge (postal reminder, telephone contact) needs to become more effective. The mixture of postal reminder and telephone contact proved to be effective (cf. Albright et al., 2005), but the question remains whether a greater amount of postal and telephone contacts or different, i.e. even more specific content, would have caused the decrease of values at the time points 3, 4 and 5 to level off. Additionally, we still don't know who profits most from an intervention programme like MoVo-LISA. One future task will be to identify those people, and to develop a screening tool for selection.

ACKNOWLEDGEMENTS

The present study was funded by the German Pension Insurance Company (Deutsche Rentenversicherung Bund). We hereby confirm that the research

has obtained relevant local ethical approval and was carried out in accordance with universal ethical principles. There are no conflicts of interest in the conduct and reporting of the research.

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