Long-term effects of a psychological group intervention on physical exercise and health:

The MoVo concept

Reinhard Fuchs[1], Wiebke Göhner[2] & Harald Seelig[1]

[1]University of Freiburg, [2]Catholic University of Applied Sciences

in press:

Journal of Physical Activity and Health

February, 2010

ABSTRACT

Background: Little is known about the long-term effects of group intervention programs targeting physical exercise. This paper reports on the effectiveness of MoVo-LISA, a theory-based (MoVo-concept) standardized intervention program. Participants are taught cognitive-behavioral strategies of goal-setting, action planning, barrier management and self-monitoring.

Methods: *N*=220 in-patients of an orthopedic rehabilitation clinic were assigned to the usual care group (UCG) or the intervention group (IG) (quasi-experimental design). Assessments were conducted at 5 time points.

Results: At 12 month follow-up, level of exercise in the IG was 28.5 min/week higher than in the UCG (p=.05). Moreover, 50% of the IG was exercising for at least 60 min/week, but only 33% of the UCG (p=.01). During the 12 months after clinic discharge, patients of the IG reported the same low pain experience that they had reached at the end of the clinic stay, whereas UCG patients' pain experience slowly re-increased.

Conclusions: Results provide evidence that intervention programs based on the MoVo concept lead to long-term improvement in exercise behavior and health status.

Key words: physical activity, exercise, intervention program, maintenance, pain

INTRODUCTION

The positive health effects of physical activity are well documented. Epidemiological and clinical studies show that physical activity reduces the risk of cardiovascular disease, type 2-diabetes, colon cancer, and osteoporosis; furthermore, physical activity helps people to cope with stress, anxiety and depression [1]. Although most people know about the beneficial outcomes of physical activity, only about 25% of the adults in western societies exercise at the level needed to achieve these health benefits [2]. For this reason, public health researchers and practitioners focus their attention on the development of intervention programs that enable sedentary people to adopt a physically active lifestyle.

Two major reviews summarize the status of current research regarding individual or group-focused interventions towards promoting physical activity [3; 4]. Kahn et al. [4] review individually-adapted health behavior change programs based on 18 reports. All programs taught specific self-management skills (e.g., goal setting, self-monitoring) that enable participants to increase their exercise level. Such intervention was offered to participants mainly in group settings, by mail, or telephone. Studies that measured changes in the time spent on physical activity found a median net increase of 35.4%, while studies that measured change in VO_2 max observed a median increase of 64.3%. Kahn et al. [4] conclude that "there is strong evidence that individually-adapted health behavior change programs are effective in increasing levels of physical activity" (p. 87). The review by Hillsdon et al. [3] considered 18 randomized controlled trials with a minimum six month follow-up. The effect of intervention on self-reported physical activity was positive and moderate (pooled standardized mean difference: d=0.31). Of the four studies reporting the outcome more than six months after initial intervention, two studies found significant differences in cardio-respiratory fitness levels, but *no study* found significant

differences in physical activity levels between the intervention and control group at the 12 or 24 month follow-up. The authors summarize their review by stating that "physical activity interventions have a positive moderate sized effect on increasing self-reported physical activity… at least in the short to mid-term" (p. 7). However, it is still unclear to what extent the specific components of the intervention could have contributed to the behavior changes.

The present paper reports results from an exercise-related intervention study based on the *MoVo concept* [5]. The acronym "MoVo" stands for "motivation" and "volition" indicating that this approach is related to motivation theories of health behavior [6; 7] as well as volition theories of action planning and action control [8; 9]. The MoVo concept consists of two components: the MoVo process model and the MoVo intervention program [5]. Whereas the MoVo process model provides the theoretical framework, the MoVo intervention program specifies the concrete contents and procedures applied to change people's health behavior.

MoVo process model

The MoVo process model integrates central elements of two different lines of research: social cognition research with a strong focus on motivational aspects [10] and self-regulation research emphasizing the volitional side of behavioral control [11]. The model does not claim to be a new health behaviour theory, instead it constitutes a comprehensive summary of those factors and processes that control health behaviours such as physical exercise or a low-fat diet. The model assumes that a successful set-up and maintenance of health behaviour basically depends on five psychological factors (Figure 1): strength of the goal intention, self-concordance of this goal intention, implementation intentions, volitional strategies of intention shielding, and outcome experiences. Subsequently, these five factors are briefly described using physical exercise as the target behavior.

– **Figure 1**: The MoVo process model –

Goal intention is the central motivational construct of the model [8]. Goal intentions are the result of motivational processes of weighing up the costs and benefits of adopting a particular behavior (*outcome expectancies*) and of appraising one's own ability to perform it successfully (*self-efficacy*) [6; 7]. Goal intentions are more generally expressed resolutions of the type "I intend to resume my fitness training". The MoVo process model states that it is not only the *strength* but also the *self-concordance* of a goal intention that is important to set up and maintain a new behavior. Sheldon and Houser-Marko [12] use the term "self-concordance" to denote the extent to which a specific goal intention is in accordance with the general interests and values of the person. A meta-analysis by Koestner, Lekes, Powers, and Chicoine [13] shows that the likelihood of attaining a personal goal increases with the degree to which the underlying goal intention is self-concordant. In order to translate goal intentions into real actions, goal intentions need to be furnished with *implementation intentions* [8]. Implementation intentions are simple plans, in which a person specifies the when, where, and how of an intended action. For instance: "I intend to participate at the fitness course on Tuesday 6 p.m. at the City Health Centre". Several studies have shown that the formation of implementation intentions significantly enhances the likelihood of beginning and continuing regular physical exercise [14].

Even carefully elaborated implementation intentions can be challenged by external barriers (e.g., heavy workload at the office) and internal barriers (e.g., lethargy). When faced with barriers a person needs to apply volitional strategies of *intention shielding* [9] such as mood management, stimulus control, cognitive restructuring, or attention control to keep the intended action on target. Empirical evidence that such self-regulatory processes play an important role in the realization of exercise-related implementation intentions is provided by Sniehotta, Scholz and Schwarzer [15].

Finally, the MoVo process model considers a construct called *outcome experiences*. This variable reflects the personal experiences and appraisals regarding the newly acquired behavior. After the first exercise meetings a person may conclude for example: “This training really helps me to improve my fitness”, or “The pain in my arm has reoccurred”. Based on such positive or negative outcome experiences, people confirm or change their corresponding outcome expectancies and thus maintain or modify their future goal intentions (cf. Rothman’s [16] concept of “perceived satisfaction with received outcomes”).

MoVo intervention program

Using the MoVo process model as a theoretical framework, the most important implication for the design of effective intervention programs concerns the differentiation between motivational and volitional strategies [14]. While motivational strategies aim to form a strong and self-concordant goal intention, volitional strategies focus on developing implementation competencies and action control abilities.

The MoVo intervention program encompasses the following *motivational strategies*: (a) clarification of personal health objectives (by asking participants to find out what their objectives are and how much effort they would be willing to invest in them); (b) contemplation of different actions to achieve the health objectives (by encouraging participants to balance the pros and cons of these actions, and to reflect their self-efficacy beliefs towards these actions); (c) formation of specific goal intentions (by requesting participants to decide on one or more of the actions); (d) checking self-concordance of this goal intention (by asking participants whether the goal is really their own or merely an introjection of others); and (f) reflection of outcome experiences (by supporting the participant to consciously notice especially the positive consequences of the new behavior).

In addition to the motivational strategies the MoVo intervention program places a strong emphasis on subsequent *volitional strategies*: (a) generating implementation intentions (by inviting participants to make concrete when-where-and-how-plans for their goal intentions); (b) anticipating personal barriers (by making participants think about the critical internal and external barriers that could impede their new behavior); (c) developing counter strategies (by helping participants to find individual ways of coping with the barriers); and finally (d) self-monitoring the new behavior (by encouraging participants to record their actual exercise behavior).

The MoVo intervention program exists in different versions to fit the needs of particular settings and target groups (e.g., rehabilitation; overweight groups). MoVo-LISA is one of these specific intervention programs (LISA stands for "Lifestyle-Integrated Sport Activity") developed for an in-patient rehab setting. In the Method section the specific features of MoVo-LISA are described in more detail.

Research question

The present study aims to examine the effectiveness of the MoVo-LISA intervention among in-patients of an orthopaedic rehabilitation clinic. The study design permits a comparison of the intervention group with a control group (usual care) at 5 assessment points. It is hypothesized that even 12 months after discharge from the clinic, patients who participated in MoVo-LISA show a substantially higher level of regular physical exercise than their counterparts who did not receive this intervention. Furthermore, it is expected that during the 12 months following discharge, the higher level of regular exercise in the intervention group will have contributed to a significantly lower experience of pain compared to the control group. Experience of pain is considered a major health indicator among orthopaedic patients. Since MoVo-LISA is a short and economic program

based on a standardized curriculum the evidence of its effectiveness would have implications in all those areas of health where the set-up of a physically active lifestyle is an important goal.

METHODS

Setting and participants

The target sample consisted of persons who were registered for a 3-week in-patient rehabilitation program in a clinic in Southern Germany because of orthopedic conditions (e.g. arthritis, chronic back pain, injuries etc.). Each week on average 48 patients were admitted to the clinic. Two weeks before the scheduled clinic stay, all patients were informed by mail about the aims and procedures of the study, asked for their willingness to participate and, if they decided to participate, requested to fill out the attached informed consent and first questionnaire (t1). Based on data from this t1-assessment, only those patients were included in the further study who met two criteria: (a) diagnosis of a chronic orthopedic condition (arthrosis, chronic back pain, etc.), and (b) self-report of being sedentary (defined as "0 minutes of 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. Participation was on a voluntary basis; there were no disadvantages for patients who refused to participate.

Study design

The quasi-experimental study design encompasses a control group and an intervention group. Patients of the control group underwent the regular clinic program (usual care) that consisted of a complex regime of medical, physiotherapeutic and psychological therapies specific to orthopedic patients (for more information on the German system of medical in-patient rehabilitation: [25]) . Patients of the intervention group received the regular clinic program as well, but *additionally*

participated in the MoVo-LISA intervention. The t1-assessement of the control group took place from November 2005 to March 2006; the t1-assessment of the intervention group was conducted from May to July 2006. The MoVo-LISA program was only implemented into the clinic after the discharge of all patients of the control group (April 2006). The study design did not allow randomisation procedure because MoVo-LISA was introduced into the *whole clinic*; the program was started with a "kick-off meeting" for all clinic staff; all therapeutic personnel (most notably physiotherapists, psychologists and physicians) played a specific role within this program. If we had implemented MoVo-LISA at the same time as we collected data from the control group study participants of both groups (in-patients) would have had informal talks and changed information about the program. 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 of the control group have left the clinic. Consequences for internal validity will be discussed later in limitations of the study.

Questionnaires were filled out in both groups at five assessment points: 2 weeks before the clinic stay (t1), at the end of the 3-week clinic stay (t2), 6 weeks after clinic (t3), 6 months after clinic (t4), and 12 months after clinic (t5). All questionnaires were mailed to the participants' home addresses, except those at t2 which were distributed and collected within the clinic.

Sample

Power analyses (expected intervention effect at t3: d=0.5) indicated a required longitudinal sample size of approx. N=240 (longitudinal sample: complete data on the five points of assessment; control group: n=120; intervention group: n=120).

For recruitment of the *control group,* a total of 1,024 persons were invited to participate in the study, of which 681 agreed by sending back the completed t1-questionnaire (response rate:

66.5%). Of those 681 persons, 429 were excluded from the study either because they rescheduled their clinic stay (32 persons did not start their in-patient rehabilitation program as planned), or because they did not meet the two inclusion criteria (38 persons were not diagnosed with chronic orthopedic condition, 359 persons were not sedentary). Thus, the *starting sample* (intent-to-treat sample) of the control group at t1 consisted of *n*=252 persons. Of these 252 persons, 85.3% (*n*=215) participated at the t2-assessment, 71.0% (*n*=179) at t3, 61.9% (*n*=156) at t4, and 61.5% (*n*=155) at t5.

For recruitment of the *intervention group,* a total of 696 persons were invited to participate in the study, of which 432 agreed by sending back the completed t1-questionnaire (response rate: 62.1%). Of those 432 persons, 281 were excluded from the study (5 rescheduled their clinic stay, 21 did not have the required diagnosis, and 255 were not sedentary). Thus, the *starting sample* of the intervention group at t1 (intent-to-treat sample) consisted of *n*=151 persons. Of these 151 persons, 136 (90.1%) actually participated at all components of the MoVo-LISA intervention that were administered at the clinic. Major reasons for not (completely) attending the MoVo-LISA meetings were: refusal of further participation after the first group meeting (8 persons), and interference with other therapeutic activities (7 persons). Those 15 persons who did not receive the full intervention program were excluded from the further assessments (t2 to t5). Of the 151 patients of the starting sample, 87.4% (*n*=132) participated at the t2-assessment, 80.8% (*n*=122) at t3, 68.2% (*n*=103) at t4, and 69.5% (*n*=105) at t5.

The major analyses reported in this paper are based on the *longitudinal samples* of the control group (*n*=132) and the intervention group (*n*=88), in which complete data on the five points of assessment for all subjects are available (completer sample). A socio-demographic description of both longitudinal samples at t1 is shown in Table 1. The groups differed significantly only with

respect to their age, however, the age difference is small (2.1 years) and unlikely to threaten the comparability of the groups. – *Dropout analyses* revealed no significant differences between t5-participants (*n*=260) and t1-t5-dropouts (*n*=143) on the variables sex, age, body mass index (BMI), education, employment status, rehab history, and admitting diagnoses.

– **Table 1**: Demographic Characteristics of the Sample at Baseline (t1) –

Intervention

The contents and procedures of the MoVo-LISA program are standardized and documented in a detailed curriculum published elsewhere [5]. In the current study, the MoVo-LISA intervention was realized by five instructors (trained clinic staff: one psychologist and four physiotherapists) who were trained to conduct the program by the scientific project team during a two-day seminary. MoVo-LISA consists of five components: first group meeting (6 patients per group), one-on-one interview, second group meeting, postal reminder (3 weeks after discharge) and short telephone contact (5 weeks after discharge). The first group meeting was scheduled 60 minutes and took place in the second week of the three-week clinic stay. The one-on-one interview lasted 10 minutes per patient and took place at the end of the stay (last but one day before discharge). The second group meeting was scheduled 90 minutes and took place on the very last day of the stay.

In the first group meeting, each patient clarifies his/her health goals ("What are my personal health goals? What health condition do I want to reach?"). In the next step, patients define what kind of action they would be ready to take in order to attain their health goals. For this purpose, patients are asked to collect several *exercise ideas*, e.g., activities such as Nordic walking or swimming, in which they could see themselves taking part. After further deliberation patients finally choose their favourite exercise – ideally, they choose the exercise idea that they imagine

they could implement into their daily routine in the long run. During the time span of about seven days between the first group meeting and the one-on-one interview, patients are requested to transfer their favourite exercise idea into an *exercise plan*. This is done by answering the following questions in detail: Does the exercise idea meet my personal interests and dispositions (self-concordance)? Would the exercise idea be practical for me, i.e., would it fit into my daily family and job routine? Next, patients are asked to write out an exercise plan in detail by describing when, where and how they plan to perform the exercise (implementation intentions). Last, with support of physicians and physiotherapists, the exercise plan is reviewed with respect to its effectiveness in attaining the personal health goals.

Developing an exercise plan is the most difficult part of the MoVo-LISA intervention, because only few people have ever thought about their exercise behavior in any detail. Therefore, the one-on-one interview is crucial for discussing the exercise plan with regard to its self-concordance, its practicability and its effectiveness, but most important for checking its precision. In this interview, the instructor does not only help patients by exploring the “correct” exercise plan, but questions critically whether the exercise plan is really cast-iron. Once patients have generated a satisfying exercise plan, they transfer it in writing into their personal records.

The second group meeting starts out with each patient presenting his/her exercise plan. The main topic of this meeting is the identification of internal and external barriers that could potentially hinder or even overthrow the plan. Finally, the very last topic of the second group meeting is the development of personally relevant counter-strategies to overcome the barriers. Personal barriers as well as personal counter-strategies are written down in the records of each patient.

After discharge, the main problem is the practical implementation of the exercise plan into the daily routine of the patients. In order to gain high action control, patients keep minutes of their performance of the exercise plan over a time span of six weeks (self-monitoring). To strengthen their commitment, patients are asked to mail their protocol back to the project manager six weeks after discharge. Three weeks after discharge a postal reminder is sent to all participants; it consists of a memo card and a letter. The memo card graphically summarizes the contents of MoVo-LISA and patients are advised to place it in a central position in their homes. The letter also recalls the contents of MoVo-LISA and ends with the announcement of the planned telephone contact in two weeks time. (The telephone contact had been previously announced at the end of the second group meeting.) This telephone contact, the very last part of the intervention, serves to inquire how the patients progressed with their exercise plan in the meantime, about newly emerged barriers and strategies and to discuss how to overcome the barriers, and how patients could improve the implementation of the exercise plan into their daily routine even more. Self-monitoring, postal reminder and telephone contact all take on an important function in establishing a strong commitment to the new exercise behavior.

Measures

The questionnaires for the five points of assessment were identical except for questions on demographic variables assessed at Time 1 only. All psychological constructs of the MoVo process model and various subjective health indicators were assessed [17]. However, in this publication we only report on behavioral variables (physical exercise) and health variables (pain experience).

Physical exercise was assessed by asking the patients whether they currently perform one or more sport or exercise activities on a regular basis, to write down these activities and to indicate for each both the frequency (per month) and the duration (per episode). For the construction of our

"Physical Exercise Index" (minutes per week) only those activities were considered that involve larger groups of skeletal muscles and lead to the acquisition or maintenance of endurance capacity (e.g., jogging), strength (e.g., gym exercises), flexibility (e.g., yoga), and/or coordination skills (e.g., dancing). Based on this definition, activities such as billiards, fishing, and chess were excluded. Our measure was based on the so-called FITT-structure (FITT: frequency, intensity, time, and type) that characterises most of the commonly used self-report measures of physical activity (e.g., Minnesota Leisure Time Questionnaire; [18]). From many studies it is known that these FITT measures have substantial evidence of reliability and validity ([19], pp. 76-79).

To measure *pain experience* patients were asked how often they currently suffer from the following seven conditions: headache, pain in the neck, the shoulders, the back, the arms and/or hands, the legs and/or feet, and joint pain. The five-point response scale ranged from "never" (coded as 1) to "very often" (coded as 5). For the construction of a "Pain Index" the values of the seven items were summed up and divided by seven (mean of item scores). Descriptive statistics for the Pain Index at our first point of assessment (t1) were: *M*=3.53; *SE*=0.05; *SD*=0.71; median=3.57; skewness=-0.30; excess=-0.33; range=1-5; Cronbach's alpha = .76).

RESULTS

Of the 403 participants who were selected for the study (intent-to-treat sample), 220 provided data on all 5 points of measurement (completer sample). Subsequently, we focus on the findings from the completer sample; afterwards we compare these findings with those obtained from the intent-to-treat sample.

Completer analyses

(1) *Behavior change: Means.* Means in the Physical Exercise Index are shown in Figure 2a. An analysis of covariance for repeated measures (*N*=220) with two factors (group [2], time [4]) and

sex and age as covariates (2×4 ANCOVA) yielded a significant interaction term group-by-time [F (3, 648) = 10.69; p = .001; η^2 = .05] indicating a substantial effect of the MoVo-LISA intervention on the level of physical exercise. Sex and age were considered as covariates because both groups differed substantially on these two variables (see Table 1). However, since both covariates did not show significant effects on the dependent variable we subsequently report observed means (not adjusted for sex and age): At t1 all participants reported to perform no physical exercise (M = 0 min/week) since this was the selection criterion. At t2 (end of clinic stay) there was no assessment of physical exercise: the specific exercise therapy provided at the clinic was not comparable with normal daily exercise performed before and after the clinic stay. Six weeks after discharge (t3) the level of physical exercise had increased in both groups although the increment was much higher in the intervention than in the control group [156.0 vs. 83.5 min/week; F (1, 218) = 27.3; p=.000; η^2 = .11; d=.72; critical p-level=.017 (Bonferroni-Holm adjustment [26]; B-H adj.)]. Six months after discharge (t4) the level of physical exercise had diminished in both groups but the intervention group remained markedly more active than the control group [91.7 vs. 59.5 min/week; F (1, 218) = 5.9; p=.016; η^2 = .03; d=.33; critical p-level=.025 (B-H adj.)]. Finally, at the 12 month follow-up (t5) the difference between both groups was still 28.5 min/week [96.1 vs. 67.6 min/week; F (1, 218) = 3.9; p=.050; η^2 = .02; d=.27; critical p-level=.050 (B-H adj.)].

– Figure 2 –

(2) *Behavior change: Prevalence.* Figure 2b displays the percentage of participants who reported exercising at least 60 minutes per week (Physical Exercise Index ≥ 60 min/week; N=220). The cut point of 60 minutes per week was chosen because our Physical Exercise Index did not only include moderate-intensity activities (e.g., bicycling to work, Nordic walking) but also vigorous activities (e.g., running, playing soccer, fitness training) for which the recommendation of “150

minutes light to moderate activity per week" [20] would not have been appropriate. Thus, the cut point of 60 minutes per week should be considered rather a behavioral than a medical criterion.

Both groups started at t1 with a prevalence rate of 0% (which was one of the inclusion criteria). Six weeks after discharge (t3) there was an increase to 78.4% in the intervention group and 46.2% in the control group [group difference at t3: χ^2=22.6; *p*=.000; φ =.321; *d*=.68; critical p-level=.017 (B-H adj.)]. Afterwards prevalence rates were reduced substantially in both groups at t4 to 47.7% and 33.3%, respectively [χ^2=4.6; *p*=.032; φ =.145; *d*=.29; critical p-level=.050 (B-H adj.)]. Finally, at t5 in the intervention group the percentage of active persons was 17.4% higher than in the control group [50.0% vs. 32.6%; χ^2=6.7; *p*=.010; φ =.175; *d*=.35; critical p-level=.025 (B-H adj.)].

(3) *Health change: Means in the Pain Index.* Figure 2c illustrates the intervention effect on the health indicator "pain experience". An analysis of covariance for repeated measures (*N*=220) using the Pain Index as dependent variable and sex and age as covariates yielded a significant interaction term group-by-time [F (4, 824) = 3.16; $p < .014$; $\eta^2 = .02$]. Since both covariates showed significant effects on the dependent variable (age: *b*=.02; *p*=.032; sex: *b*=.36; *p*=.001), means in Figure 2c were adjusted for sex and age. Starting at t1 with rather high levels of pain experience, both groups profited substantially from the therapeutic programs at the clinic (parallel decrease from t1 to t2 in both groups). Note that there was *no* significant difference between both groups at t2 supporting the contention that the primary focus of MoVo-LISA is on behavior change – and not on the change in the health condition. At t2, in the intervention group the planned exercise behavior did not yet exist and could therefore not have led to any health differences. However, while in the control group the level of pain experience re-increased steadily from t2 to t5, in the intervention group it remained rather stable at a stage that was reached at the

end of the clinic stay [mean difference at t5: 3.08 vs. 2.79; F (1, 206) = 6.61; p=.011; η^2 = .03; d=.36; critical p-level=.017 (B-H adj. for 3 one-way comparisons at t3, t4 and t5 each; at t1 and t2 no significant differences were hypothesized)].

Intent-to-treat analyses

All analyses of the preceding paragraph (completer analyses) were repeated with the intent-to-treat sample (intervention group: n=151; control group: n=252) using the *last observation carry-forward* method [21]. Results of the intent-to-treat analyses are summarized in Table 2. Analyses of covariance for repeated measures with two factors (group [2], time [4]) and sex and age as covariates (2×4 ANCOVA) yielded a significant group-by-time interaction term for Analysis 1 (F [3, 1197] = 8.90; p<.001; η^2=0.02). In Analysis 3 the interaction term did not reach the level of statistical significance (F [4, 1576] = 1.86; p = 0.12; η^2 = 0.01). In Analyses 1 and 2 (Physical Exercise Index) between group comparisons revealed significant differences at t3, t4, and t5 (all p-values < .03); Analysis 3 (Pain Index) yielded significant differences at t3 (p = .05) and t5 (p = .03), but no significant differences at t4 [p = .11]). In general, the intent-to-treat analyses confirm the pattern of findings from the completer analyses.

– Table 2: Intent-to-treat analyses **–**

DISCUSSION

Results of both the completer and intent-to-treat analyses suggest that the MoVo-LISA intervention was effective in increasing the level of physical exercise in patients who were inactive before their participation in a rehabilitation program. Twelve months after discharge, the intervention group was still more active than the usual care group by 28.5 minutes per week (p=.05) (completer sample). Furthermore, at this follow-up 50% of the MoVo-LISA patients were

active for at least 60 minutes per week but only 33% of the usual care patients (p=.01) (completer sample). These findings deserve special attention for several reasons:

The behavioral effects seem to be relatively strong compared to the findings of previous studies. In the review by Hillsdon et al. [3] no study found significant differences in physical activity levels between the intervention and control group at the 12 month follow-up. A more recent intervention study by Moore et al. [22] – also conducted in a rehab setting and in many respects comparable to MoVo-LISA – reported a mean difference of only 8 minutes per week between the intervention and control group at the follow-up after one year. We attribute MoVo-LISA's success primarily to the systematic translation of theoretical concepts (MoVo process model) into a curriculum-based interactive group intervention (in contrast to interventions that mainly rely on individual paper-pencil work; e.g. filling out working-books).

Furthermore, intervention effects may be considered "strong" because in the study clinic even the usual care was conducted at a high quality level. This is not only concluded from the personal impression that we received during the many visits to the clinic, but also from the marked improvements from t1 to t3 in the control group (see Figure 2). Therefore, additional intervention effects were not easily accomplished; the net effect of 28.5 minutes per week after 12 months is therefore an indication of a successful intervention strategy over and above that of the established "good practice".

Effects can be reproduced because they were achieved by a standardized program documented in a detailed curriculum [5]. The five instructors who carried out the MoVo-LISA intervention at the study clinic were continuously supervised by the program manager to ensure intervention integrity. The instructors reported that "in general we realized the program as put down in the curriculum", but of course with slight modifications when required by the specific

group situation. The instructors were regular members of the clinic staff without any previous experience in lifestyle modification programs.

Effects were obtained at a relatively low cost. The personnel costs of the MoVo-LISA intervention are comprised of the requirements for the first group meeting (60 min for 6 patients), the one-on-one meeting (10 min for 1 patient), the second group meeting (90 min for 6 patients), the postal reminder after 3 weeks (10 min per patient), and the telephone call after 5 weeks (10-15 min per patient). This adds up to about 60 minutes per patient (without preparation time). Figure 2c shows that during the months following discharge, the level of pain experience in the intervention group remained as low as it was at the end of the clinic stay, whereas in the control group the level of pain experience slowly re-increased. The different development of pain experience in the intervention and control group might be due to the different levels of physical exercise in both groups. However, this is only speculation and certainly needs to be substantiated by more controlled cause-and-effect analyses.

The external validity of these findings should be reasonable because the recruitment of participants was not seriously biased by self-selection. *All* patients entering the clinic during a specific period were eligible for recruitment if they had a chronic orthopedic condition and if they reported to be sedentary. Patients who met these criteria were automatically selected for the "MoVo-LISA course" and had it prescribed by their physicians as a regular part of their personal rehab program. Of those selected, 9.9% did not participate in the intervention. Although this non-compliance contains some elements of self-selection, the external validity of the study may not be seriously limited by the recruitment of motivated volunteers.

Finally, it should be mentioned that not only the exercise behavior, but also the underlying psychological mediators (as outlined in Figure 1) were positively affected by MoVo-LISA. The

intervention effects on these mediators are complex and therefore have been published in an extra article [17].

Limitations

External validity of the findings is threatened by a sampling bias due to the fact that the study was conducted in only one clinic (convenience sample) and due to a response rate of 66.5%. Internal validity is limited by an attrition rate (t1 to t5) of 35.5% and by a selection bias due to a small, however significant age difference at t1. Two further limitations need a closer consideration:

Non-randomized design. A major threat to the internal validity of the findings originates from the non-randomized design of the study. In investigations like the one presented in this paper recruitment procedures for the intervention and control group can not be based – at reasonable costs – on randomization because the intervention consists of a change of the whole institution with all staff (creating a "MoVo climate" in the clinic). A randomized assignment of patients to different treatment conditions within the same time period therefore is not feasible. For this reason we applied a sequential group design in which the control group and intervention group were recruited consecutively. Both groups were selected according to the same procedures and criteria, the only difference lies in the period of observation or intervention. Although at the t1-assessment both groups turned out to be highly comparable with regard to socio-demographic variables (Table 1) and psychological characteristics [17], it is possible that the different periods of observation or intervention may have had a systematic impact on the findings. It could be that the difference between the groups – for instance 6 weeks after discharge (Figure 2a+b) – is partly due to seasonal factors. One may contend that MoVo-LISA participants became more active because it was summer when they left the clinic and it might be easier to start new activities at this time of the year. When the control group left the clinic in fall or winter, this could have been an

unfavourable time to begin regular exercise. However, there are two arguments that speak against this "season hypothesis": (1) There is no (scientific or "every day") evidence that it is easier to start a new exercise behavior in summer than in fall or winter. Fitness centers do not report higher admission rates for summer than for winter months [23]. (2) Even if there were such seasonal effects, they should show up in both groups as distinctive behavior patterns (i.e., there should be higher levels of physical exercise in both groups at those times of assessment that took place during the summer months). However, our in-depth analyses – not reported here – did not identify such patterns. We therefore assume that the findings have not been substantially biased by seasonal factors.

Social desirability. One may argue that the observed intervention effects are biased by socially desired response tendencies that are stronger in the intervention than in the control group. The applied intervention activities (group meetings, one-on-one meeting, postal reminder, and telephone call) may have contributed to a special commitment to the study that could dispose intervention participants to report more "desired" results. We cannot completely rule out the occurrence of such a biased response. With the integration of MoVo-LISA in the regular clinic program and not highlighting it as a special innovation of a research group, we tried to counteract this potential problem beforehand. Furthermore, the almost identical means on the Pain Index for the intervention and control group at the end of the clinic stay (t2) (Figure 2c) also suggest that social desirability effects in both groups are similar and therefore do not seriously threaten the internal validity of results.

Future prospects

There is no intervention equally suited to everyone. With any specific program we can only ever reach a certain segment of the population [24]. This is also true for the MoVo-LISA intervention.

Results reported in this paper suggest that with MoVo-LISA we are able to reach another 15-20% of all sedentary patients who are ready for change but who would not receive sufficient guidance from the usual rehab programs to actually transform their readiness into concrete actions. With MoVo-LISA, the rate of those who exercise at least 60 min/week increased up to 50% after 12 months (control group: 33%; Figure 2b) – also indicating that 50% of the target group remained un-affected by this intervention. For those persons other programs need to be developed that better match their social and personal predispositions. Further analyses of the data will reveal the psychological characteristics of those participants that profited most from the MoVo-LISA intervention. Based on these characteristics screening procedures should be developed to help identify those patients for which MoVo-LISA would be the optimal answer to their physical inactivity. It is expected that in such selected groups, the rate of effectiveness of the program can be markedly enhanced (*differential intervention*).

REFERENCES

[1] Warburton D, Nicol C, Bredin S. Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*. 2006; 174:801-809.

[2] USDHHS – U.S. Department of Health and Human Services. *Healthy people 2010*. Washington, DC: U.S. Department of Health and Human Services; 2000.

[3] Hillsdon M, Foster C, Thorogood M. Interventions for promoting physical activity. *The Cochrane Database of Systematic Reviews*, Issue 1. Art. No.: CD003180.pub2. DOI: 10.1002/14651858.CD003180.pub2; 2005.

[4] Kahn E, Ramsey M, Brownson R, et al. The effectiveness of interventions to increase physical activity. *American Journal of Preventive Medicine*. 2002; 22:73-107.

[5] Fuchs R, Göhner W, Seelig H. eds. *Aufbau eines körperlich-aktiven Lebensstils. [Setup of a physically active lifestyle]* Göttingen: Hogrefe; 2007.

[6] Ajzen I. The theory of planned behaviour. *Organisational Behaviour and Human Decision Processes* 1991; 50:179-211.

[7] Bandura A. Health promotion from the perspective of Social Cognitive Theory. In: Norman P, Abraham C, Conner M, eds. *Understanding and changing health behaviour*. Amsterdam, NL: Harwood Academic Publishers; 2000:299-339.

[8] Gollwitzer P. Implementation intentions. *American Psychologist*. 1999; 54:493-503.

[9] Schwarzer R. Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review*. 1994;9:161-180.

[10] Conner M, Norman P. *Predicting health behavior: Research and practice with social cognition models*. Maidenhead, UK: Open University Press; 2005.

[11] Baumeister, R & Vohs, K. *Self-regulation. Research, theory, and applications*. New York, NY: Guilford Press; 2004.

[12] Sheldon KM, Houser-Marko L. Self-concordance, goal attainment, and the pursuit of happiness: Can there be an upward spiral? *Journal of Personality & Social Psychology*. 2001; 80(1):152-165.

[13] Koestner R, Lekes N, Powers T, Chicoine E. Attaining personal goals: Self-concordance plus implementation intentions equals success. *Journal of Personality & Social Psychology*. 2002; 83:231-244.

[14] Milne S, Orbell S, Sheeran P. Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology*. 2002; 7:163-184.

[15] Sniehotta F, Scholz U, Schwarzer R. Bridging the intention-behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology and Health*. 2005; 20:143-160.

[16] Rothman A. Toward a theory-based analysis of behavioral maintenance. *Health Psychology*. 2000; 19:64-69.

[17] Göhner W, Seelig H, Fuchs R. Intervention effects on cognitive antecedents of physical exercise. *Applied Psychology: Health and Well-Being*. 2009; 1:233-256.

[18] Taylor H, Jacobs D, Schucker B, et al. A questionnaire for the assessment of leisure time physical avtivities. *Journal of Chronic Diseases*. 1978; 31:741-755.

[19] Sallis J, Owen N. *Physical activity and behavioral medicine*. Thousand Oaks, CA: Sage; 1999.

[20] Haskell WL, Lee I-M, Pate RR, et al. Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Circulation*. 2007; 116 (9): 1081-1093.

[21] Shao J, Zhong B. Last observation carry-forward and last observation analysis. *Statistics in Medicine*. 2003; 22:2429-2441.

[22] Moore SM, Charvat J, Gordon N, et al. Effects of a CHANGE Intervention in increase exercise maintenance following cardiac event. *Annals of Behavioral Medicine*. 2006; 31:53-62.

[23] DSSV – Deutscher Sportstudio Verband [German Association of Fitness Studios] . *Eckdaten 2007 [Statistics for 2007]*. Hamburg: Sportstudio Verlag; 2007.

[24] Marcus B, Dubbert P, Forsyth L, et al. Physical activity behavior change: Issues in adoption and maintenance. *Health Psychology*. 2000; 19 (No.1, Suppl.):32-41.

[25] Jaeckel W, Bengel J, Herdt, J. *Research in rehabilitation*. Stuttgart: Schattauer; 2006.

[26] Holm S. A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics*. 1979; 6 (2): 65-70.

Figure 1:
The MoVo process model

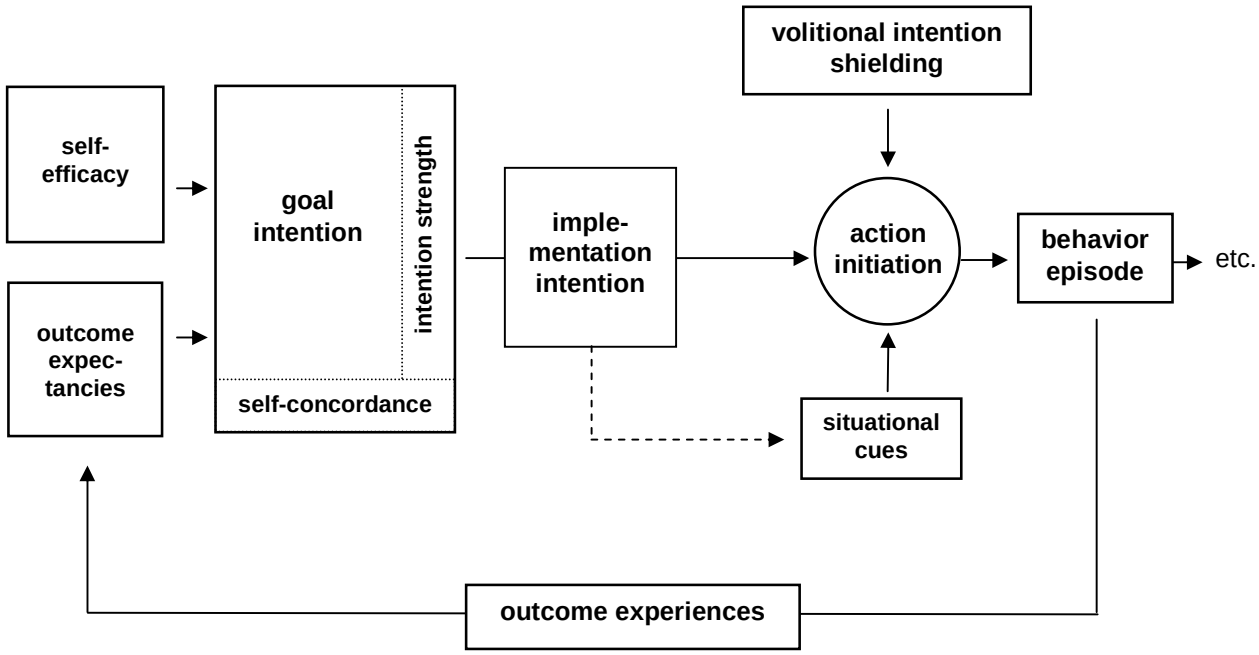

Figure 2:

(a) Means of physical exercise (min per week); (b) Percentage of participants who exercise for at least 60 minutes per week; (c) Means of pain experience (adjusted for sex and age)

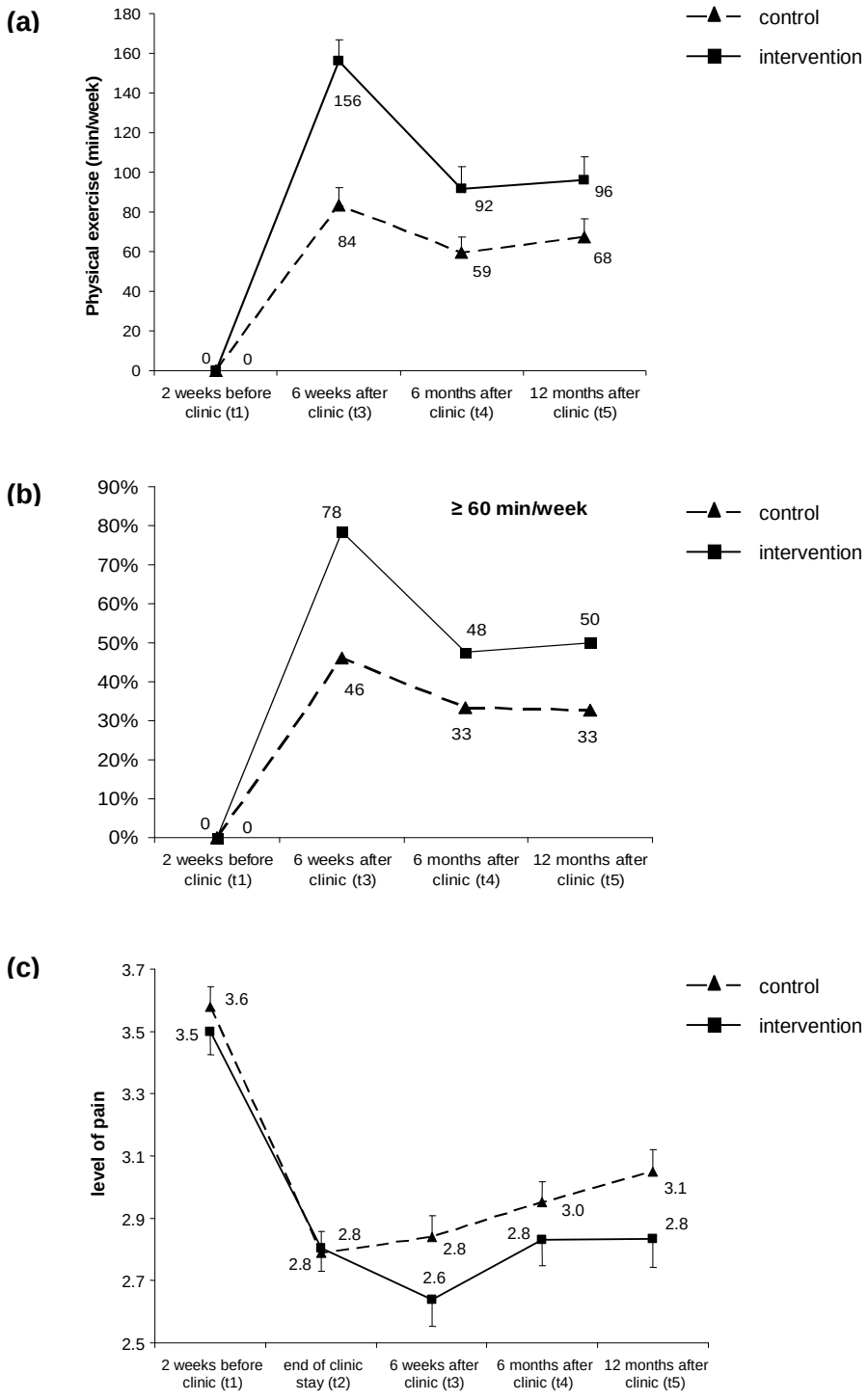

Table 1

Demographic Characteristics of the Sample at Baseline (t1)

Characteristic	intervention group (*n*= 88)		control group (*n*=132)		difference between groups
Age [years; M (SD)]	52.3	(6.3)	50.2	(7.2)	*p*=.03
Body Mass Index [kg/m²; M (SD)]	29.0	(4.9)	28.6	(5.3)	*p*=.54
Sex [n; (% of group)]					
Female	57	(64.8)	69	(52.3)	*p*=.07
Partnership [n; (% of group)]					
Alone living	18	(20.5)	21	(15.9)	
With partner	70	(79.5)	111	(84.1)	*p*=.39
Education [n; (% of group)]					
No degree	1	(1.1)	3	(2.3)	
Hauptschule[a]	46	(52.3)	66	(50.0)	
Realschule[b]	26	(29.5)	29	(22.0)	
Abitur[c]	4	(4.5)	7	(5.3)	
University	5	(5.7)	18	(13.6)	
Other	6	(6.8)	9	(6.8)	*p*=.43
Employment status [n; (% of group)]					
Currently unemployed	9	(10.2)	6	(4.5)	
Part time work	20	(22.7)	33	(25.0)	
Full time work	59	(67.0)	93	(70.5)	*p*=.26
Rehab history [n; (% of group)]					
In-patient treatment before	43	(49.4)	57	(43.2)	*p*=.36
Admitting diagnoses					
Chronic back pain	39	(44.3)	58	(43.9)	
Arthritis	19	(21.6)	34	(25.8)	
Post-surgical status	12	(13.6)	21	(15.9)	
Other	18	(20.5)	19	(14.4)	*p*=.32

[a] basic secondary school; [b] middle-level secondary school; [c] general qualification for university entrance; M = mean; SD = standard deviation; *n* = number of cases.

Table 2

Intent-to-treat analyses: Scores at last observation

		t1	t2	t3	t4	t5
Analysis 1: *Physical Exercise Index* means (standard error) [min/week]	IG	0.0 (0.0)	-	112.8 (8.4)	75.7 (7.7)	78.3 (8.3)
	CG	0.0 (0.0)	-	63.2 (6.5)	50.4 (6.0)	55.7 (6.4)
Analysis 2: *Physical Exercise Index* percentage (≥ 60 min/week)	IG	0.0	-	58.1	40.3	41.5
	CG	0.0	-	33.8	27.5	26.7
Analysis 3: *Pain Index* means (standard error)	IG	3.5 (0.1)	2.9 (0.1)	2.8 (0.1)	2.9 (0.1)	2.9 (0.1)
	CG	3.6 (0.1)	2.9 (0.1)	3.0 (0.1)	3.1 (0.1)	3.1 (0.1)

t1 = 2 weeks before clinic; t2 = end of clinic stay; t3 = 6 weeks after clinic; t4 = 6 months after clinic; t5 = 12 months after clinic; IG = intervention group (*n*=151); CG = control group (*n*=252)