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Initiation and Maintenance of Physical Exercise: Stage-Specific Effects of a Planning Intervention

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Achieving a recommended level of physical exercise is a difficult self-regulatory task for many patients in rehabilitation. Psychological interventions are designed to improve initiation and maintenance of exercise. A challenging research question is whether such interventions can be tailored to the special needs of patients at different stages of behavioral change. In particular, this article investigates whether action planning is beneficial for those patients who have the intention to exercise but do not perform physical activities at the recommended level. In a longitudinal (4 waves) study with 560 rehabilitation patients, a planning intervention was evaluated. Action plans and exercise behaviors were higher in the experimental planning group than in the no-treatment control group. Patients with the intention to exercise but who have been inactive benefited more from the planning intervention than patients without the intention to act or patients who had been active before. The results suggest that matching treatments to people in a particular stage is a promising procedure. Moreover, if patients formed intentions and action plans, they were more likely to adhere to the recommended level of exercise.

Keywords rehabilitation, intentions, planning, stage-matched interventions

Introduction

Regular physical exercise enhances health and aids recovery from health limitations (Clarke 1999). Although most people know about the benefits, many individuals are either sedentary or exercise with a frequency and duration insufficient to

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improve their health (Stephens and Caspersen 1994). People with health limitations have a great need for physical activity and are at highest risk of being inactive and nonadherent after an exercise program (Hutchinson, Skrinar, and Cross 1999). To develop activity-enhancing interventions, it is imperative to understand which processes drive behavior change (MacRea, Miller-Perrin, and Tinberg 2003). Establishing a suitable theoretical framework of health behavior change is a precondition to improve exercise adherence.

Stages of Health Behavior Change

Interest in stage models of health behavior change has increased because they describe how individuals move through discrete stages while preparing and changing their behavior. Stages are categories into which people can be classified according to the rules of stage theory (Weinstein, Rothman, and Sutton 1998).

A variety of stage models have been developed, such as the Transtheoretical Model (TTM; Prochaska, DiClemente, Velicer, et al. 1993) and the Health Action Process Approach (HAPA; Schwarzer 1992; 2001). The latter has been selected as the theoretical backdrop for the present study because it makes a distinction between a motivation stage and a volition stage of health behavior change. The basic idea is that individuals experience a shift of mindset when moving from the first stage (i.e., motivational) to the second stage (i.e., volitional). The moment when people commit themselves to an intention to exercise, they enter the volitional stage. In this stage, a division into two substages appears to be meaningful, where people can be labeled as either intenders or actors. First, they intend to act but have not yet tried. Second, they have initiated the intended action. Thus, the HAPA contains three stages. In (1) the *nonintentional* stage, individuals develop a behavioral intention. Afterward, people enter (2) the *intentional* stage, in which they have already formed an intention but remain inactive. They plan and prepare the exercise behavior. If individuals translate these plans into action, they reside in (3) the *actional* stage, being physically active at the desired or recommended level.

Stage theories assume that individuals at the same stage face the same barriers, which are distinct from barriers in other stages. According to the HAPA, individuals in the intentional stage face the barriers of translating their intention into action and getting started. Stage theories identify the factors that induce movement from one stage to the next. When people have formed intentions, they may plan subsequent behavior (Milne, Orbell, and Sheeran 2002). Planning helps intenders move to the actional stage. Thus, a planning intervention would be a matched intervention for intenders but a mismatch for nonintenders.

Action Planning and Coping Planning

In the nonintentional stage, it is crucial to form an intention. If the intention is formed, the individual has to plan the action. Thus, intention formation and

action planning can be understood as two distinct processes, the latter requiring self-regulatory effort (Koestner, Lekes, Powers, et al. 2002).

Leventhal, Singer, and Jones (1965) have stated that fear appeals help change health behavior only when combined with specific instructions on when, where, and how to perform them. Recent attention to planning emerged when the concept of implementation intentions was introduced (Gollwitzer 1999; Milne, Orbell, and Sheeran 2002). Several interventions included action planning successfully (e.g., PACE by Calfas, Sallis, Zabinski, et al. 2002).

Action plans have the structure, "When situation S arises, I will perform response R." They improve cognitive links between situational circumstances or opportunities, and the goal behavior (Gollwitzer 1999). If one defines the appropriate opportunity for a desired action clearly, procrastination becomes less likely. The more elaborately the action is mentally simulated, the higher is the probability to initiate the intended behavior.

Milne, Orbell, and Sheeran (2002), for example, used action plans to increase subsequent exercise behavior. Students in the intervention group were asked to write down when—in terms of day(s) and time of day—and where they would partake in physical exercise. These individuals were more likely to actually exercise than controls who received no intervention and controls who were equally motivated to act, but who did not specify their implementation intention. People do not forget their intentions easily when they have specified their intention in a when, where, and how structure (Koestner, Lekes, Powers, et al. 2002).

Additional coping plans, which are plans on how to cope with obstacles in the pursuit of the goal, are superior to action plans alone (Koestner, Lekes, Powers, et al. 2002; Sniehotta, Scholz, and Schwarzer 2003). The mental simulation is improved when people anticipate obstacles and distractions, and when they specify corresponding coping plans. If specific distractions occur during the performance of the behavior, the coping plans work by starting the distraction management automatically. Some intervention programs have successfully included such coping plans. For example, Blissmer and McAuley (2002) integrated strategies of how to deal with setbacks effectively in their intervention.

Stage-Matched Interventions

Blissmer and McAuley (2002) found that for physical exercise, the matched intervention and the standard care were better than the mismatched and control conditions (no intervention). In general, if individuals received the tailored intervention, significantly more participants met or exceeded exercise participation goals at the end of the intervention period and maintained this level of physical activity than people receiving the standard care intervention (Kreuter and Holt 2001; Marcus, Bock, Pinto, et al. 1998).

Tailored interventions are optimal for subgroups and suboptimal for other groups (Kreuter and Holt 2001). In other words, an intervention matched to one

stage should be mismatched to a different stage (Nigg 2003). By confirming this assumption experimentally, the results support the existence of the stages. Thus, a planning intervention matches the intentional stage, whereas it mismatches the nonintentional stage: A planning intervention should be optimal for persons who are intentional (but have been inactive in the past) because they intend to initiate a new activity. In contrast, individuals in the nonintentional stage, initially, have to form an intention. This stage, therefore, should be inappropriate for a planning intervention. Furthermore, individuals who are active already are in the maintenance stage, and do not benefit as much as intenders do. In this stage, people have to overcome the difficulties of the maintenance of their behavior (such as relapse prevention), which should also be inappropriate for this planning intervention.

The aim of the present study was to evaluate a planning intervention and its stage-specific effects. The planning intervention was compared to a no-intervention condition within three stage groups: nonintenders, intenders, and actors. Furthermore, the effect of the planning intervention was compared to the subsequently formed intention and action plans to investigate the experimental effect of the planning intervention along with the "spontaneous" effect of the previous stage, subsequent intention, and action plans, as well as gender and age differences. The study investigated a sample of orthopedic patients because they are advised to be physically active on a regular basis to stay healthy and to maintain treatment outcomes.

Research Questions

The main purpose of the study was to investigate whether the planning intervention is efficient for volitional processes only while patients are at the intentional stage. It was hypothesized that (1) the planning intervention has no effect on intention formation but rather on action plans.

Regarding the target behavior, it was hypothesized that (2) the planning intervention increases the probability of postrehab exercise in terms of a higher percentage of adherent patients. The effects should be stronger in intentional compared to nonintentional and actional individuals. Because intenders and actors have both formed an intention, the differences between these two groups should be less than between nonintenders and intenders or nonintenders and actors, respectively.

In addition, exercise variance should be accounted for by the intervention and the prerehab stage as well as by other predictors. It was hypothesized that (3) stages, intentions, and action plans are predictors of postrehab adherence rates. This draws on the general expectation that intention and planning would promote subsequent behavior. The aim was to investigate their effects over and above the stage effects (all three as "spontaneous" effects) and the planning intervention effect (experimental effect).

Method

Sample

The recruitment approach was as follows: Orthopedic patients in an out-patient rehabilitation center were enrolled in exercise therapy. They had to meet the inclusion criteria of being capable of exercising on their own and able to fill out a questionnaire. As the study involved telephone follow-ups, only patients with access to a telephone were recruited. Participation in the study was voluntary. Patients were diagnosed with a number of ailments, such as spinal diseases; surgery of bones, joints, muscles, or ligaments; constraints in movement; chronic pain; arthrosis and arthritis; and stroke.

A total of n = 560 patients were approached for the interviews. Of these, 44 patients at Wave 3 (2 weeks after discharge) and 56 patients at Wave 4 (4 weeks after discharge) could not be interviewed because they were unavailable: Patients could not be reached due to technical difficulties (no telephonic connection), were not at home (informed by other household members), or did not answer the telephone (answering machine). Participants aged 15 to 80 completed the surveys in the rehabilitation center. Participants were primarily female (62%), reported limitations in movement (65%), and were living with a partner (69%). The mean body mass index (BMI) of the women was 25.45 (SD = 5.07, median = 24.13), and for the men it was 26.63 (SD = 3.59, median = 26.28).

Study Design

The study was conducted in a rehabilitation center for orthopedic patients. An experimental, randomized, prospective design was used over approximately 6 weeks. Prior to exercise therapy (Wave 1), patients were informed about the research by a sport therapist and were given an information sheet about the study. To ensure anonymity and to encourage frank responses, all study materials had a code number, not the patient's name. After obtaining informed consent, patients were handed the prerehab questionnaires regarding physical activity prior to the rehabilitation, social–cognitive variables, and demographic variables such as age, limitations in movement, and partner status. At the end of their rehabilitation period (2–3 weeks after Wave 1), patients were scheduled to meet with a research assistant (Wave 2). Following the questions on their intended subsequent physical activity, the patients were randomized by a computer program to either (1) receiving a planning intervention (see intervention section) or (2) being in the no-planning group. Two planning intervention groups were proposed to investigate more features of this intervention. However, this aspect was not a part of the study; therefore, the two groups were combined and, accordingly, the planning intervention group was expected to contain two-thirds of the sample and the control group one-third.

After the intervention, patients were asked to fill out the second questionnaire. They were scheduled for an additional interview two weeks after discharge

(Wave 3) and at four weeks after the rehab (Wave 4). At Wave 3 and Wave 4, trained interviewers called the patients at home. The interviewer was not aware of the treatment the patient was assigned to during rehabilitation. The interviews lasted approximately 10 to 15 minutes.

Medical and Sport Psychological Treatment

The rehabilitation therapy consisted of a standard program (3 to 10 hours per day) of medical and sport psychological treatment that aimed at motivating patients to become active at the recommended level. All patients received verbal information on the benefits of activity of at least twice per week, for at least 20 minutes, and on the health risks of not meeting these criteria. Sport therapists provided information on concrete exercises and monitored the sessions in the rehabilitation. Every patient received advice from the rehabilitation physician to perform special exercises and to train at the recommended level (at least twice per week for 20 minutes or more per session).

Intervention Procedure

The planning intervention consisted of a planning sheet in which participants were encouraged to write down up to three further physical activities they intend to do and to form action plans such as "I will perform the following physical activities . . . " by specifying where, when, how often, how long, with whom, and by what means. Additionally, barriers should be anticipated and coping plans to overcome these difficulties were formed. ("What could keep you from exercising? How could you be physically active in spite of these obstacles?") All questions were open-ended, and the entire planning intervention required only 5 to 10 minutes.

Measures

Questionnaires and interviews contained several psychometric scales in addition to demographic information. Items were taken from Fuchs (1997) and adapted to the special sample of orthopedic rehabilitation patients. The validity was confirmed by development strategies such as qualitative and "think-aloud" interviews (Plotnikoff 2002). All item examples given below are translated from German. Intentions and action plans were assessed at all measurement points in time (Waves 1 to 4). Physical exercise was measured at the beginning of the rehabilitation (Wave 1) and twice afterward (Waves 3 and 4). The stage was assessed at prerehab (Wave 1) only.

Intentions to perform physical activities were assessed with three items: "I intend to exercise for 20 minutes or longer, at least on two days per week and on a regular basis." "I intend to exercise occasionally, for 20 minutes or longer on at

least two days per week (at least once a month)." And, "I intend to perform fitness and muscle strengthening activities." The items were rated on a four-point Likert scale with the anchors *not at all true*, *not true*, *a little true*, and *absolutely true*. The mean of the three items was calculated, and the reliability of the intention scale was at Wave 1 $\alpha = .61$, at Wave 2 $\alpha = .53$, at Wave 3 $\alpha = .74$, at Wave 4 $\alpha = .79$.

Action plans were measured with the question, "How precisely did you plan your exercising on two or more days per week, for at least 20 minutes?" The participants had to rate the five statements: "I already planned precisely . . . which physical activity I will perform; . . . when; . . . where; . . . with whom, and . . . how I will exercise." All items had the anchors *not at all true*, *not true*, *a little true*, and *absolutely true*, and the mean of the five items was computed. The reliability of the planning scale was at Wave 1 $\alpha = .98$, at Wave 2 $\alpha = .88$, at Wave 3 $\alpha = .89$, at Wave 4 $\alpha = .92$.

The Kaiser Physical Activity Survey (Ainsworth, Sternfeld, Richardson, et al. 2000) was translated into German and adapted to the special sample of orthopedic rehabilitation patients. Three domains of recommended physical exercise performed in the week before rehabilitation were addressed: (1) fitness activities; (2) exercises to train muscle strength; and (3) game sports, such as volleyball or golf. Taken together, it was assessed if one or more of these activities was performed for at least a 20-minute duration on two or more days.

*Measurement of exercise stages.*The aim was to assess three stages that reflect the prerehab motivational and self-regulatory status of the patients in the most parsimonious manner. Therefore, patients were asked, "What is a typical week like for you (before the rehab started)? Have you engaged in physical exercises for 20 minutes or longer, in such a way that you were at least moderately exhausted?" If persons responded with "yes," they were classified as actors. If they responded with "no," they were further classified into intenders by endorsing one of the following statements: "I have made a decision to start exercising a new activity soon," or "I have made a decision to start exercising an old activity soon." Or, they were categorized as nonintenders by endorsing one of the statements: "I am not thinking about exercising," or "I was thinking about exercising (again), but I have not yet made up my mind."

Missing Values Treatment

In the questionnaires, 70% of the participants answered all items and 20% produced one or two missing values. No item had more than 13% missing values. Missing values in the intention and action planning items were imputed with SPSS MVA Regression with age, gender, and responses to the other subscale items as predictors in linear multiple regression analyses (cf., Fidell and Tabachnick 2003).

For patients in the sample with no data at the entire measurement point at Wave 3 or Wave 4, another method to impute missing data was applied. Study

dropout is a common problem in longitudinal and treatment evaluation studies in the areas of health and risk behaviors (Gadbury, Coffey, and Allison 2003; Hall, Delucchi, Velicer, et al. 2001). Several strategies to handle these missing data have been developed. One technique that has been recommended in obesity trials is the "last observation carried forward" (LOCF). Thereby, the persons' missing outcome is replaced with outcomes observed in previous measurement points (Gadbury, Coffey, and Allison 2003; Hall, Delucchi, Velicer, et al. 2001). That is, if a patient was not interviewed at Wave 3, the data of Wave 1 for behavior and of Wave 2 for intention and action plans were copied. If no data for Wave 4 were available, the data of Wave 3 were used.

Data Analysis

Primary analytic techniques included Chi^2-tests and contrast tests for frequency data (see Rosenthal and Rosnow 1985) and analyses of covariance (ANCOVA). To determine whether the prediction of exercise adherence differed between the intervention group and the control group, a logistic regression was used.

Results

Stage Distributions and Characteristics

About one-half of the sample (n = 259; 45%) were active prior to the rehab and were, therefore, identified as actors. All of them had been active at the recommended level before rehab started. One-third of the sample (n = 195; 35%) were inactive but had the intention to start exercising and were categorized as intenders. None of these was active at the recommended level. One-fifth of the sample (n = 106; 20%) were inactive without the intention to exercise at the recommended level and were categorized as nonintenders. None of the intenders and nonintenders was active at the recommended level.

At Wave 1, nonintenders scored significantly lower in terms of intention and action plans ($p < .01$) than intenders. Intenders and actors had equivalent means for intentions and action plans (both $p > .27$) at this measurement point.

Preliminary Analyses

Analyses were conducted to determine the comparability of the intervention group and the no-intervention group. Demographic variables and each of the dependent variables were evaluated at Wave 1. The intervention group consisted of n = 352 patients receiving a planning intervention and n = 208 patients in the no-intervention group. Patient groups did not differ in terms of mean age and sex ($p > .55$). No significant differences were obtained at baseline between the two groups on intention and action planning($p > .06$).

To check the randomization, distributions of the stage groups were explored: n = 58 (55%) nonintenders received the planning intervention, and n = 48 (45%) were in the no-intervention group. Of the intenders, n = 127 (65%) were randomized into the planning intervention group, and n = 68 (35%) were in the no-intervention group. Of the actors, n = 167 (65%) were in the planning intervention group, and n = 92 (35%) were in the no-intervention group. No significant differences were found: $Chi^2(2) = 3.73$; $p = .16$. Thus, the randomization of the prerehab stage groups (one-third of the sample to the control group; see method section) had been successful.

Dropout Analysis

The study dropout was slightly different in the intervention and the no-intervention group. Patients in the no-intervention group were more likely to drop out. In this group, n = 187 (90%) patients provided data at Wave 3, and n = 182 (88%) patients at Wave 4. In the planning intervention group, n = 331 (94%) patients provided data at Wave 3, and n = 327 (93%) patients at Wave 4. This was not of statistical significance at Wave 3, $Chi^2(1) = 3.22$; $p = .07$, but at Wave 4, $Chi^2(1) = 4.60$; $p = .03$.

All dropouts were noted as being unavailable due to technical problems, were not at home, or did not answer the phone. It was not clear if this was due to technical or motivational problems. However, to control for potential effects of a motivation deficit, subsequent analyses were first computed with the group of participants who were assessed at all measurement points, and then with the LOCF-imputed variables for all patients (Gadbury, Coffey, and Allison 2003; Hall, Delucchi, Velicer, et al. 2001). No differences were found. Therefore, in the following, only results with the full sample and LOCF-imputed data are being reported.

Effects of the Intervention on Intention and Action Planning

To test the effect of the planning intervention on intention and action plans at the end of rehabilitation (both measured as continuous variables), ANCOVAs were computed. Due to the fact that the intervention group and the no-intervention group differed at prerehab (see Figure 1 and 2), an ANCOVA was employed that controlled for the baseline. Intention and action plans (Wave 2) were used as dependent variables, the intervention and control groups as first factor, the three prerehab stages as second factor, and the prerehab (Wave 1) as covariate.

On intention, neither an effect of the intervention nor an interaction was significant ($F_{intervention}[1, 559] = 1.07$, $p = .30$; $F_{interaction}[1, 559] = 1.45$, $p = .23$). In other words, none of the stage groups at Wave 2 was significantly higher in the intervention group than in the group without intervention (Figure 1). The differences between the stage groups in terms of intention at Wave 1 persisted over time ($F_{stage}[2, 559] = 8.09$, $Eta^2 = .03$, $p < .01$): Patients who had been diagnosed

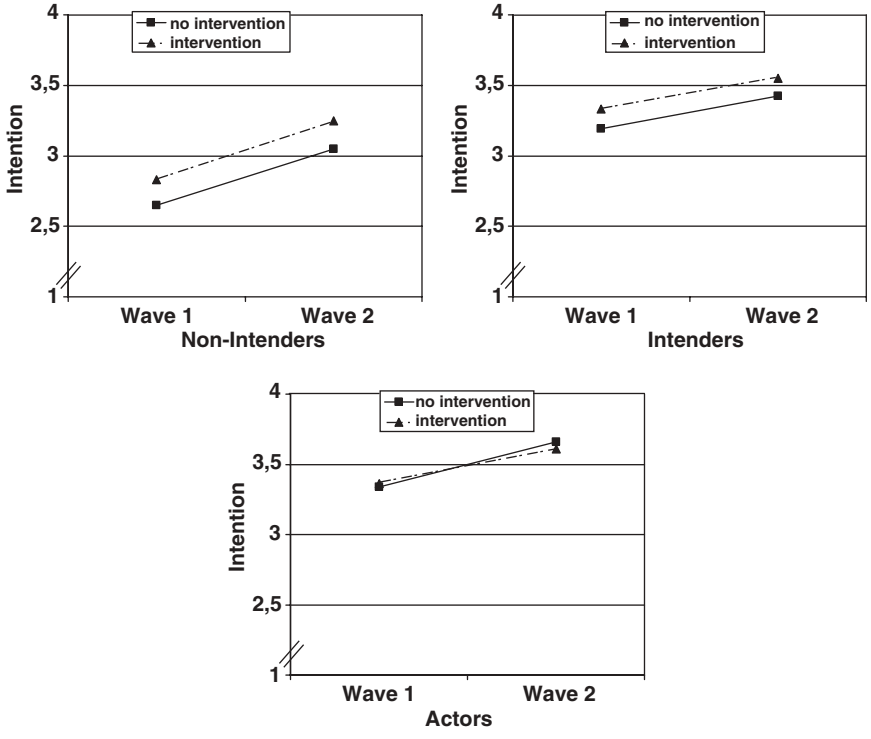

Figure 1. Means of intention in the three stage groups at Wave 1 and Wave 2.

as intenders or actors in the beginning of the rehab (Wave 1) still had a higher intention than nonintenders at the end of rehab (Wave 2). The same was true for action plans: Patients who had been diagnosed as intenders or actors in the beginning of the rehab had higher action plans than nonintenders at the end of rehab ($F_{stage}[2, 559] = 4.02$, $Eta^2 = .01$, $p < .02$).

As hypothesized, in action plans at Wave 2, the intervention group had higher post means, $F_{intervention}(1, 559) = 11.58$, $Eta^2 = .02$, $p < .01$. The interaction was not significant, and the stage-specific effects were tested more precisely by separate pair-comparisons. Significant differences in action plans were found in nonintenders ($Eta^2 = .04$, $p < .05$) and intenders ($Eta^2 = .03$, $p < .02$) but not in actors ($Eta^2 = .01$, $p = .27$; see Figure 2). Besides that, the ANCOVA revealed that initial action plans were predictive of later action plans ($F_{plans\ at\ Wave1}[1, 559] = 97.52$, $Eta^2 = .15$, $p < .01$). This was also the case for intention ($F_{intention\ at\ Wave\ 1}[1, 559] = 161.51$, $Eta^2 = .23$, $p < .01$). As a conclusion, hypothesis 1 was supported: The planning intervention had no effect on intentions but on action plans.

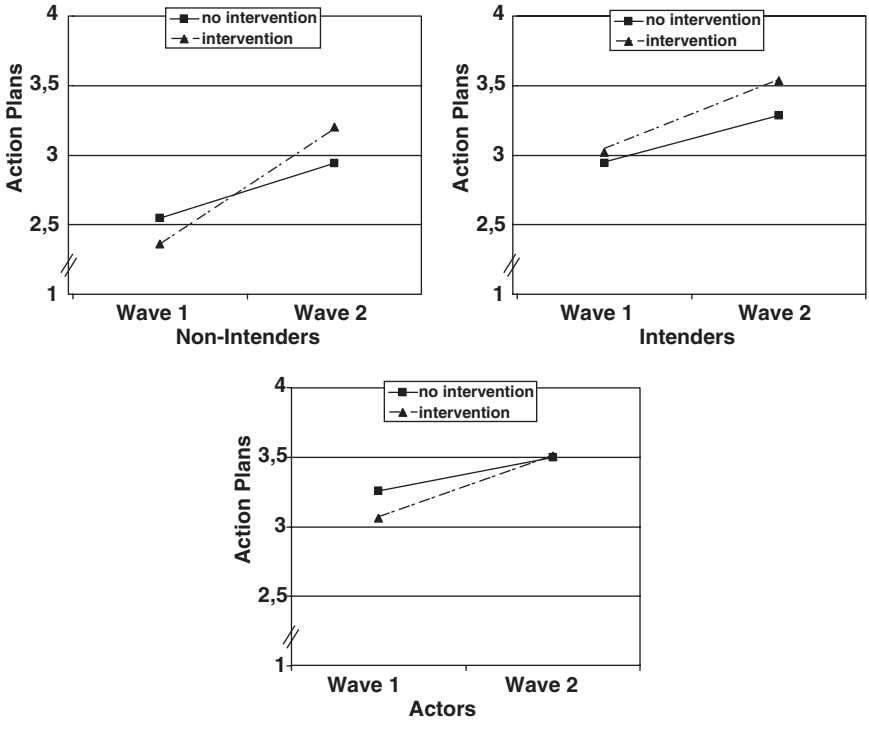

Figure 2. Means of action plans in the three stage groups at Wave 1 and Wave 2.

Effects of the Intervention on Behavioral Variables

To investigate if the planning intervention increased the probability of postrehab behavior, the percentages of the three stage groups being active at least twice per week for 20 minutes in the no-intervention patients and those with planning intervention were compared (Table 1). It seemed that for all stage groups taken together, the planning intervention resulted in higher adherence rates. However, this was only of statistical significance at Wave 4.

Differentiated into the three stage groups, the hypothesized pattern was found: If the individuals were intenders or actors, the planning intervention assisted in meeting the recommended activity level. However, it revealed that the nonintenders did not benefit from the intervention.

At Wave 4, differences between the intervention and no-intervention group were larger than differences at Wave 3. The effects were highest in intenders. If intenders received the planning intervention, an additional 8% of the patients

Table 1
Adherence at the Two Follow-Up Waves: Percentages and Frequencies (in Parentheses)

	Planning intervention	No intervention	Chi^2/p
Patients exercising at the recommended level at Wave 3			
Non-Intenders (all physically inactive at Wave 1)	41% (24)	56% (27)	2.33/.09
Intenders (all physically inactive at Wave 1)	57% (72)	49% (33)	1.19/.17
Actors (all physically active at Wave 1)	72% (120)	70% (64)	0.15/.40
All three stage groups	61% (216)	60% (124)	0.17/.37
Patients exercising at the recommended level at Wave 4			
Non-Intenders (all physically inactive at Wave 1)	67% (39)	71% (34)	0.16/.43
Intenders (all physically inactive at Wave 1)	79% (100)	65% (44)	4.52/.03
Actors (all physically active at Wave 1)	89% (148)	83% (76)	1.84/.12
All three stage groups	82% (287)	74% (154)	4.39/.02

became adherent at Wave 3 compared to those patients without intervention, and 14% at Wave 4, correspondingly. In actors, the differences were not as high: At Wave 3, an increase of 2% and at Wave 4, of 6% were found. In nonintenders, the intervention did not lead to a higher rate of adherent patients (Table 1).

Contrast tests for frequency data (Rosenthal and Rosnow 1985) were computed to compare differences across the stage groups (see Appendix). At Wave 3, significant differences were between nonintenders and intenders ($Z = 2.58$, $p < .01$), whereas at Wave 4, differences were smaller ($Z = 1.57$, $p = .06$). At both Waves, differences between nonintenders and actors were significant (Wave 3: $Z = 2.33$, $p = .01$; Wave 4: $Z = 1.90$, $p = .03$). No significant differences could be found between intenders and actors at any Wave (Wave 3: $Z = 0.58$, $p = .28$; Wave 4: $Z = 0.67$, $p = .25$). Accordingly, intenders and actors (patients in the intentional and actional process) did not differ as much as did intenders and nonintenders.

As a conclusion, hypothesis 2 can be supported: The planning intervention increased the probability of postrehab behavior in terms of a higher percentage of

adherent patients and with superior effects in intentional compared to nonintentional individuals. In actors, the direction of the effects was as expected and their size was, as hypothesized, very small.

Intervention and Stage Effects on Meeting the Adherence Goal

Logistic regression analyses were computed to determine the effects of the intervention on the total sample (all three stage groups together) in conjunction with sex and age, the developed intentions, and plans.

The first logistic regression analysis demonstrated that patients who received the planning intervention had a higher odds ratio of exercise adherence at Wave 4 than those without a planning intervention (odds ratio = 1.55, $p = .04$). The –2 Log Likelihood value for the model was 575.01 (Nagelkerke R Square = .01.)

In a second logistic regression analysis, the intervention effects were reestimated, controlling for participants' demographics to ensure that age and sex did not influence adherence rates at Wave 4. Furthermore, the prerehab stage was included. To assess the contribution of subsequent intention and action plans over and above these variables, the additional variables were entered in a second block (see Table 2). Thus, the two blocks consisted of (1) sex, age, intervention condition, and stage at prerehab; (2) intention at Wave 3 and action plans at

Table 2
Prediction of Adherence at Wave 4

	Block 1		Block 2	
Variables in the equation	OR	*p*	OR	*p*
Sex (1 = male; 2 = female)	1.10	.67	1.25	.34
Age	1.00	.67	1.01	.36
Intervention (0 = non, 1 = intervention)	1.51	.06	1.53	.06
Non-Intentional Stage	1.00	<.01	1.00	<.01
Intentional Stage (1 = intentional stage; 0 = nonintentional stage)	1.22	.47	0.82	.50
Actional stage (1 = actional stage; 0 = nonintentional stage)	2.74	<.01	2.20	.01
Intention Wave 3			2.21	<.01
Action Plans Wave 4			1.56	<.01

Wave 4. Table 2 shows the results of the logistic regression. The estimated intervention effects were similar to the unadjusted estimates already reported above.

In addition, patients who were in the actional stage at prerehab were 2.74 times more likely to be adherent at Wave 4 than those in the nonintentional stage at prerehab. Being in the intentional stage compared to being in the nonintentional stage at prerehab, the variables sex and age were not significantly predictive for adherence. The variables sex and age were not significantly predictive for adherence when comparing the intentional stage to the nonintentional stage. The initial –2 Log Likelihood value was 556.89 (Nagelkerke R Square = .07).

In the second block (see Table 2), subsequent intention and action plans were entered. A significant improvement in the –2 Log Likelihood value ($Chi^2 = 155.70$, $df = 2$, $p < .01$) occurred. At this step, intervention and the actional stage were still significant independent predictors of Wave 4 exercise adherence. The –2 Log Likelihood value for this model was 500.99 (Nagelkerke R Square = .20). To conclude, hypothesis 3 was supported: The prerehab-stage, the planning intervention, intentions, and action plans predicted postrehab exercise adherence.

Discussion

The study examined the effects of a planning intervention on exercise adherence. $N = 560$ out-patients in a rehabilitation center were included in a longitudinal study. Patients were randomly assigned to a group receiving a planning intervention and a group without intervention. Stage-specific effects of the planning intervention were assessed in terms of intentions, action plans, and postrehab exercise behavior.

Effects of the Planning Intervention

The planning intervention resulted in higher levels of action plans and adherence rates in the total sample. Split up into stage groups, higher adherence rates were found only for patients in the intentional stage. The findings supported the hypothesis that the planning intervention affected exercise behavior and action plans only, but not intentions, and only in individuals in the intentional stage rather than those in the nonintentional stage.

During the stay in the rehabilitation clinic, differences between the stage groups decreased, and prerehab nonintenders became more similar to prerehab intenders. This development may be interpreted as a regression to the mean or may mean that some nonintenders increased their intention due to the rehabilitation stay and the brief psychological counseling, indicating that previous nonintenders moved toward the intentional stage.

The effects of the planning intervention were not large, which may be caused by the study design. The planning intervention consisted of a brief psychological counseling of 5 to 10 min. in duration. This was on top of an intensive rehabilitation therapy over 2 to 4 weeks, in which the patients received treatments several

hours per day. The effects are small but clinically important because they show that brief and relatively inexpensive counseling is additionally helpful (Clarke 1999).

Stage-Specific Effects of the Planning Intervention

The planning intervention increased the action plans in nonintenders and intenders, but it did not improve behavioral intentions in any patient group. Actors already had high action plans at the beginning of the rehabilitation and, therefore, no further increase in action plans might have been possible. Although nonintenders in the intervention group increased their action plans more than the ones in the control group, they were not able to translate their plans into action. Intenders improved their action plans and became significantly more adherent, whereas actors became slightly more adherent. Thus, the planning intervention was mainly helpful for patients in the intentional and actional stages. Comparing these two stages, no differences were found between intenders and actors. This highlights related processes in these two stage groups in terms of gaining from the planning intervention. The significant differences between intenders in the intervention and the control groups imply that intenders constitute the ideal target group of planning interventions.

If resources are scarce, a planning intervention should be applied to patients at the intentional stage only. Nonintenders did not benefit from the planning intervention because the intervention was obviously mismatched (see also Kreuter and Holt 2001). At the end of rehab, some of the nonintenders may still be nonintentional when receiving the planning intervention. If nonintenders are forced to plan an activity that they do not want to perform at all, they may not even try the behavior spontaneously. Calfas and colleagues (2002) have also found the superior effects of intended behavior ("targeted behavior") than unintended but planned behavior. If interventions did not target a particular behavior, the intervention was less effective.

Influences Above and Beyond the Planning Intervention on Postrehab Behavior

To investigate whether intentions and action plans would increase the amount of variance explained in exercise adherence in addition to the intervention and the prerehab stage, all variables were tested at the same time. High intentions to become active as well as specific plans at Wave 3 emerged as significant predictors of adherence at Wave 4. Thus, it is important to move patients to a high intention level—however, this was not the aim of the planning intervention—and to make them plan their activities for postrehab behavior. Producing action plans "spontaneously" had the same impact as being in the planning intervention groups. Accordingly, developing action plans is the main issue, whether

they stem from explicit planning intervention or as a result from different sources.

The prerehab actional stage had the same impact on subsequent behavior as having the intention to become active after the rehab. That is, it was easier to restart or maintain an activity than to initiate it, and exercise is more likely if this is an intended target behavior. Sex and age did not play a role in this process.

Selective Dropout

While investigating the dropout in the intervention group and the no-intervention group, it was found that patients in the no-intervention group were more likely to drop out. Selective dropout is a common problem assessing health behaviors in longitudinal designs. Prochaska and colleagues (1993) found the same pattern: higher dropout rates in the groups with less optimal interventions or without any intervention. Earlier studies applied different strategies to deal with these dropouts. The LOCF method (Gadbury, Coffey, and Allison 2003; Hall, Delucchi, Velicer, et al. 2001) was used in this study, and results of these imputed variables were compared with results of the subgroup of participants who were present at all measurement points in time. The comparisons showed no differences between the two groups.

Limitations

The present study has several limitations. First, self-selection may have led to a sample of participants who were interested in the topic of physical activity and health. Recruitment strategies aimed to deal with this problem: The study embraced the staff of the rehabilitation clinic and invited all patients enrolled in sport therapy to participate (see method section). Further research is needed to replicate those findings in other patient groups or nonclinical samples. Second, all data are self-reported, and it may only be concluded from other studies (e.g., Ainsworth, Sternfeld, Richardson, et al. 2000) that these data are reliable and valid (Plotnikoff 2002).

Implications

The findings are important in three ways. First, the planning intervention is helpful in terms of postrehab behavior, mainly for patients in the intentional stage. Second, the intervention, the prerehab stage, postrehab intentions, and action plans are significantly predictive of postrehab behavior. With this knowledge, improved tailored and effective interventions may be designed (see Nigg 2003). Third, the problem of handling missing data and keeping as much information as possible was included. Missing data were treated by applying the LOCF method that is typically used in studies on substance dependency and obesity, and was applied to physical activity.

Concluding, the results support the assumption that nonintentional and intentional processes should be differentiated, and that a planning intervention is mainly effective for the intentional stages. This points to the benefit of including stage-specific analyses of intervention effects. The existence of stage-specific effects would allow the design of more effective, stage-tailored interventions (Nigg 2003). For rehabilitation settings, the assessment of stages can save resources by targeting those patients who would benefit from a planning intervention. Furthermore, planning interventions are an option to increase the activity-enhancing outcome of the rehab by brief psychological counseling.

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Appendix

Contrast Analyses in Proportions

Suggested by Rosenthal and Rosnow (1985).

$$Z = [\Sigma (P\ \lambda)] / \sqrt{[\Sigma (S^2_P\ \lambda^2)]}$$

I) Wave 3
A1 ← *n* nonintenders with intervention being adherent at Wave 3
A2 ← *n* intenders with intervention being adherent at Wave 3
A3 ← *n* actors with intervention being adherent at Wave 3
B1 ← *n* nonintenders without intervention being adherent at Wave 3
B2 ← *n* intenders without intervention being adherent at Wave 3
B3 ← *n* actors without intervention being adherent at Wave 3

	(1)	(2)	(3)	Sum
(A)	24	72	120	216
(B)	27	33	64	124
(N) = A + B	51	105	184	340
(P) = B/N	0.5294	0.3143	0.3478	
$S^2_P = [P(1 - P)]/N$	0.0049	0.0021	0.0012	
λ 1 (H1)	+1	–1	0	
λ 2 (H2)	+1	0	–0	
λ 3 (H3)	0	–1	+1	

Z (1) = [0.5294 (1) + 0.3143 (–1) + 0.3478 (0)] / √ 0.0049 (1) + 0.0021 (1) + 0.0012 (0)
= 0.2151 / √ 0.007 = 0.2151 / 0.0837 = 2.5799; *p* = .01
Z (2) = [0.5294 (1) + 0.3143 (0) + 0.3478 (–1)] / √ 0.0049 (1) + 0.0021 (0) + 0.0012 (1)
= 0.1816 / √ 0.0061 = 0.1816 / 0.0781 = 2.3252; *p* = .01
Z (3) = [0.5294 (0) + 0.3143 (–1) + 0.3478 (1)] / √ 0.0049 (0) + 0.0021 (1) + 0.0012 (1)
= 0.0335 / √ 0.0033 = 0.0335 / 0.0575 = 0.5826; *p* = .28

II) Wave 4
A1 ← *n* nonintenders with intervention being adherent at Wave 4
A2 ← *n* intenders with intervention being adherent at Wave 4
A3 ← *n* actors with intervention being adherent at Wave 4
B1 ← *n* nonintenders without intervention being adherent at Wave 4
B2 ← *n* intenders without intervention being adherent at Wave 4
B3 ← *n* actors without intervention being adherent at Wave 4

	(1)	(2)	(3)	Sum
(A)	39	100	148	287
(B)	34	44	76	154
(N) = A + B	73	144	224	441
(P) = B/N	0.4658	0.3056	0.3393	
$S^2_P = [P(1 - P)]/N$	0.0034	0.0015	0.0010	
λ 1 (H1)	+1	–1	0	
λ 2 (H2)	+1	0	–1	
λ 3 (H3)	0	–1	+1	

Z (1) = [0.4658 (1) + 0.3056 (–1) + 0.3393 (0)] / √ 0.0034 (1) + 0.0015 (1) + 0.0010 (0)
= 0.1098 / √ 0.0049 = 0.1098 / 0.07 = 1.5686; $p = .06$
Z (2) = [0.4658 (1) + 0.3056 (0) + 0.3393 (–1)] / √ 0.0034 (1) + 0.0015 (0) + 0.0010 (1)
= 0.1265 / √ 0.0049 = 0.1265 / 0.0663 = 1.9023; $p = .03$
Z (3) = [0.4658 (0) + 0.3056 (–1) + 0.3393 (1)] / √ 0.0034 (0) + 0.0015 (1) + 0.0010 (1)
= 0.0337 / √ 0.0025 = 0.0337 / 0.05 = 0.674; $p = .25$