

# Adherence to self-directed home-exercises in patients with non-specific low back pain: the relationship with readiness to change

## Master thesis

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"ONDERGETEKENDE

Laura Maaria Lundell,

bevestigt hierbij dat de onderhavige verhandeling mag worden geraadpleegd en vrij mag worden gefotokopieerd. Bij het citeren moet steeds de titel en de auteur van de verhandeling worden vermeld."

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## **SAMENVATTING**

### *Doelstelling*

Te bepalen of er een relatie bestaat tussen bereidheid tot gedragsverandering, gebaseerd op het Transtheoretische model (TTM) en 'Stages of change', en therapietrouw bij huiswerk oefeningen bij patiënten met aspecifieke lage rugpijn, die in eerstelijns fysiotherapie behandeld worden.

### *Methode*

Een cohort van nieuwe patiënten werd geobserveerd tijdens hun behandeling. Deelnemende fysiotherapeuten, verdeeld over zeven grote en middelgrote praktijken, includeerden volwassenen met subacute, recidiverende en chronische klachten. Bereidheid tot gedragsverandering werd gemeten met Pain Stages of Change Questionnaire in het begin, in de tweede en zesde week. Therapietrouw werd gemeten met Utrechtse Therapietrouw vragenlijst in de tweede en zesde week. De associatie werd berekend met Relatieve Risico.

### *Resultaten*

In totaal werden 41 van de 87 aangemelde patiënten geïncludeerd, en 23 patiënten werden gevolgd. Bij aanvang van behandeling werden 8,7% (n=2) patiënten geclassificeerd in Contemplatie, 73,9% (n=17) in Actie en 17,4% (n=4) in Maintenance 'stage'. In de tweede en zesde week waren 35,0% (n=7) van de patiënten therapietrouw (meer dan 60% van het oefenadvies gevolgd). Patiënten in de Contemplatie- fase bleken 50-60% hogere kans te hebben om *niet-therapietrouw* te zijn.

### *Conclusie*

Bereidheid tot gedragsverandering volgens het TTM was relatief hoog in deze eerstelijns steekproef. Dat impliceert dat patiënten open staan voor én bezig zijn met adoptie van nieuw gedrag. Hoewel lagere bereidheid tot gedragsverandering geassocieerd lijkt te zijn met een hogere kans voor niet therapietrouw zijn, blijkt het aantal therapietrouwe patiënten in Action and Maintenance zeer laag.

### *Klinische relevantie*

Motivationale interventie binnen eerstelijns fysiotherapie voor deze populatie lijkt niet nodig te zijn. Therapeutische huiswerk oefeningen vormen een belangrijke deel van zelfzorg voor aspecifieke lage rugklachten, en ook al lijkt deze populatie open te staan voor nieuwe (gedragsmatige) strategieën, is dat niet zichtbaar in de therapietrouw. Nieuwe strategieën zijn nodig om therapietrouw te verbeteren, en de integratie van Actie en Coping Planning in zelfmanagement verdient een aanbeveling voor toekomstig onderzoek.

## **ABSTRACT**

### *Aim*

The aim was to explore the relationship between readiness to change, as described in Transtheoretical model, and adherence to self-directed home-exercises in patients with non-specific low back pain, treated with primary care physiotherapy.

### *Methods*

A cohort of patients was prospectively observed during usual treatment in seven primary care practices in the Netherlands. Physiotherapists screened the patients for eligibility and included patients with sub-acute, recurrent or chronic non-specific LBP. Readiness to change was measured with the PSOCQ at baseline and in the second and sixth week. Adherence to prescribed home exercises was measured in second and sixth week with the UHEAQ. Association was explored using Relative Risk.

### *Results*

In total 41 of the 87 patients that signed in were included, and 23 patients were followed. At baseline, 8.7%(n=2) of the patients were classified in Contemplation, 73.9% (n=17) in Action and 17.4% (n=4) in Maintenance stage. Adherence to self-directed home-exercises (performance > 60%) was 35.0% (n=7) in the second and sixth week. In comparison with higher stages, patients in Contemplation seemed to have 50-60% higher chance for being non-adherent.

### *Conclusion*

The study shows that TTM-based readiness to change was relatively high in the studied primary care population, implying that patients were taking an active role in self-management and behavioral change. Although 'lower' readiness to change seems to be associated with higher chance for non-adherence to self-directed home exercises, the number of adherent patients even with high readiness to change remains relatively low.

### *Clinical Relevance*

There is no clear need for motivational interventions in primary care NSLBP population. Self-directed home-exercises form an important part of self-management in NSLBP care, and although patients seem open for new behavioral strategies, the majority is non-adherent. Therefore new strategies are needed to improve adherence, and future research on integration of Action and Coping Planning in self-management might offer new possibilities.

*Keywords:* Low back pain, readiness to change, adherence, exercise therapy

## INTRODUCTION

In the light of the expanding health care costs, expectations towards integration of self-management strategies within physiotherapy are growing. Physiotherapy guidelines for non-specific low back pain (NSLBP) recommend patient education and advising enhancement of physical activity to restore function and facilitate a quick resumption of work (1,2). Additionally, the use of therapeutic exercises, including self-directed home exercises, is recommended and widely used (1-5). A systematic review of Lin et al. indicates that the guideline-endorsed therapeutic exercise programs can be effective and cost-effective (6). Previous research on the effectiveness of exercise programs in several musculoskeletal disorders has shown that the effectiveness largely depends on patient's adherence to prescribed exercises (7-9). However, adherence to home-exercise programs seems to be poor to moderate: approximately 33-66% of the patients are estimated to be non-adherent to prescribed home exercises during treatment and even less continue exercising after the treatment period (9,10). Several studies have focused on the barriers for adherence and the influence of psychosocial factors in relation to facility-based exercise programs (11-13), but research specifically on adherence to therapeutic self-directed home exercises remains limited.

One explanation for insufficient adherence to self-directed home exercises could be individual's readiness to change behavior and take an active role within treatment (14). As described by Bandura in 1986, self-efficacy reflects patients' confidence in translating his internal locus of control into action and has been found to positively correlate with adherence (15). DiClemente and Prochaska studied the processes of maladaptive behavior and developed the Transtheoretical model (TTM), a theory-based bio-psychosocial model for behavioral change (15). TTM originally described individual's readiness to change as a process of five stages of change unfolding over time, which are later narrowed to four (16). The Precontemplation describes a stage where the individual does not consider any behavioral change. It is followed by the Contemplation stage, in which the awareness is increased to make effort to change behavior in the near future, but a change is not yet initiated. In the Action stage concrete actions for change are prepared and taken, and in the Maintenance stage the individual attempts to and manages to sustain the accomplished new behavior (17).

The initial stage of the individual in the beginning of the treatment has been suggested to influence the final treatment outcome, and Carr et al. explored the predictive capacity of the TTM for participation in a self-management program (18). In a chronic LBP population a positive relationship was found between Contemplation stage and the likelihood of joining a self-management program. The explanation for Contemplators' readiness to apply self-management (e.g. home exercises) could lie in the endorsement of their need for change. However, the study of Carr et al. did not measure the actual adherence to an existing self-management program, but an intention to follow one. Several other studies hypothesized

that the difference in the individuals' initial stage might explain the differences in adherence during intervention (10,19,20). In the study of Friedrich et al, a TTM-based motivational program resulted in a long-term reduced pain and disability (10). However, two other studies showed conflicting results: additional positive effects of the stage-derived motivational program (compared to control group with only exercise therapy) on treatment outcomes or adherence were not found (19,20).

Currently, the effect of stage-derived motivational intervention added to exercise therapy in general remains unclear (19,20). To date, research has not focused on the relationship of readiness to change and adherence specifically to self-directed home exercises. If readiness to change is associated with adherence to self-directed home exercises, stage-derived interventions could be further studied in physiotherapy in order to enhance self-management directed at improving treatment effectiveness. Therefore, the objective of this study is to explore the association between readiness to change, as described in the Transtheoretical model, and adherence to self-directed home exercises as recommended by primary care physiotherapists treating patients with NSLBP. It is hypothesized that most patients with NSLBP would be classified in the Contemplation or Precontemplation stage in the beginning of the treatment. Furthermore, it is hypothesized that patients initially classified in the Contemplation stage would proceed to a higher level of readiness to change during the treatment period, while patients initially classified in the Precontemplation would be less ready to progress to other stages. At last, a higher level of readiness to change is expected to be associated with better adherence to self-directed home exercises.

## **METHODS**

### *Design*

A cohort of patients with NSLBP was prospectively observed during the first six weeks of their treatment with usual care following the Dutch guideline for NSLBP. Written informed consent was obtained from all participants prior to inclusion in the study. The study protocol was approved by The Medical Ethics Committee of the University Medical Centre Utrecht and was in accordance with the declaration of Helsinki (21).

### *Participating physiotherapy practices*

The study was conducted in primary care physiotherapy practices in the Netherlands. Three large (> 10 therapists) and five average sized (4-9 therapists) practices were approached for participation, and only one declined to participate. All practices are equipped for exercising and offer diverse forms of physiotherapy (e.g. Manual Therapy). All participating therapists (n=25) were provided with information concerning the study aim, recruitment and informed consent procedure, data-collection and possible withdrawal. Physiotherapists did not have to meet certain requirements (e.g. minimum of clinical experience).

### *Recruitment of patients*

The physiotherapists screened new patients with NSLBP (1) during their first visit. When the eligibility criteria was met, an information letter was given to read before the next visit. In the second visit, informed consent was signed if the patient agreed to participate. Patients with first episode of sub-acute (six weeks or longer with insufficient recovery or longer than three weeks without any recovery), recurrent (two or more episodes within last year) and chronic (> 12 weeks or more than five episodes in the past years) NSLBP were included. The definition of recurrent NSLBP is unclear (22). In the current study it was defined as two or more episodes of NSLBP within past year, with a minimum duration of five days including limitations at work, in ADL and/or hobby's. Exclusion criteria were specific low back pain (1), recent (up to 2 years) low back surgery, physical limitations for exercising, mental problems with psychiatric treatment (e.g. depression, dementia), difficulties in understanding the protocol (such as cognitive or visual problems) and problems communicating in Dutch.

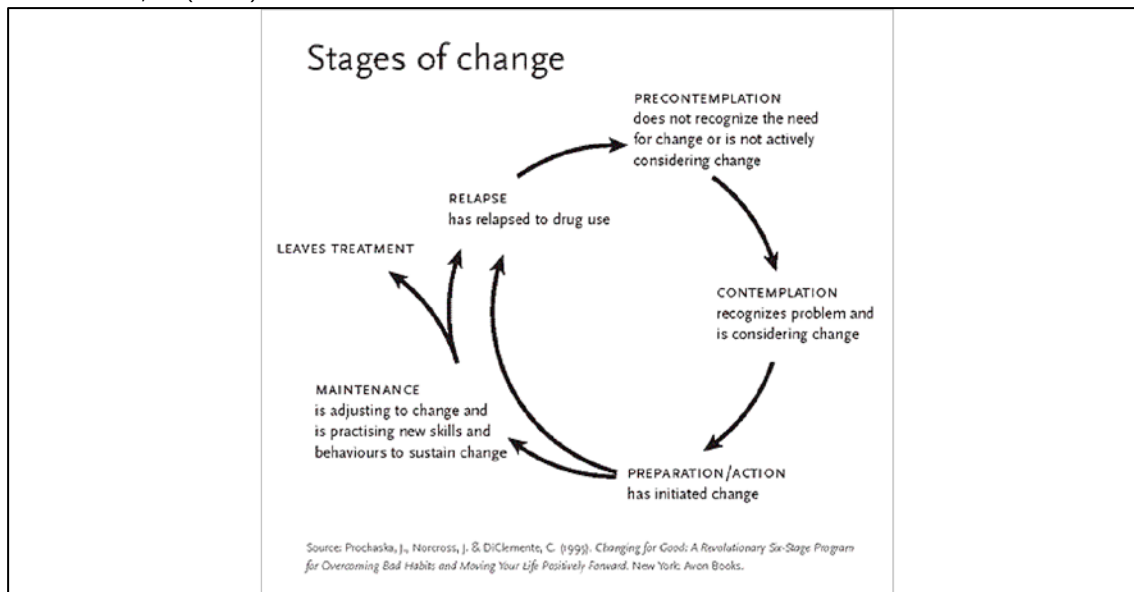
### **Outcome measures**

#### *Readiness to change*

TTM conceptualizes behavioral change as a process unfolding over time. TTM is initially developed to describe the process of individual's readiness to terminate problem behavior, such as smoking (17). Later it also has been applied in physiotherapy in enhancement of physical activity and in management of chronic pain (16,19). The *stages of change* are illustrated in Figure 1. The Pain Stages of Change Questionnaire (PSOCQ) is developed to operationalize readiness to change as described in TTM (15). It is validated and tested in patients with chronic pain to be used as a prediction tool for engagement in the cognitive behavioral therapy (23-25). The PSOCQ measures the extent to which the person accepts personal responsibility for pain control and considers making behavioral changes in the foreseeable future (16). The questionnaire consists of thirty items on a 5-point Likert scale. In PSOCQ readiness to change is divided in four stages: Precontemplation, Contemplation, Action and Maintenance, and the items are grouped in four distinct scales representing the four main stages (16). Akkermans et al. validated the Dutch language version in 2007 (25).



Figure 1. Stages of Change as described in Transtheoretical model by Prochaska, J., Norcross J. and DiClemente, C. (1995).



### *Adherence to self-directed home exercises*

Adherence to therapeutic self-directed home exercises can be defined as 'the extent to which a person's exercise behavior corresponds with agreed recommendations by a physiotherapist, such as completing specific therapeutic self-directed home exercises, with the recommended frequency, intensity and quality of performance' (26,27). The Utrecht self-directed Home Exercise Adherence Questionnaire (UHEAQ) was developed to measure adherence to recommended self-directed home exercises (27). The UHEAQ consists of two parts: *part I* contains the prescribed exercises (frequency, series and repetitions/duration). *Part II* is interview-based, consisting of questions about the actual performance of the home exercises. A score between 0 and 100 (%) reflects the agreement between part I and II; the higher the score the better the adherence (27). The questionnaire showed a moderate construct validity and test-retest reliability (ICC 0.65) in a Dutch primary care NSLBP population (27).

### *Patient characteristics*

Demographic and clinical data were collected to describe the study population: age, gender, the length of the LBP episode, the number of episodes within past year, and referral type (direct access/referral). The type of work and work participation (0-100%) were noted. Severity of the symptoms was measured with Visual analogue Scale (VAS), ranging from 0 mm (no symptoms) to 100mm (the most intense symptoms) (28). Limitations in daily activities were measured with Quebec Back Pain Disability Scale (QBPDS) that consists of 20 items, total score ranging from 0 (no limitations) to 100 (maximal limitations). QBPDS has a high internal consistency (Cronbach's  $\alpha = 0.95$ ) (29). The inter-rater-reliability is high ( $R_s = 0.90$ ) (29), (ICC = 0.90-0.94) (29,30), and the construct validity ranges from fair to good ( $R_s = 0.60-0.91$ ) (29,31).

Self-efficacy (SE) is described as a set of beliefs about one's ability to execute the actions needed to attain a required behavior (Bandura 1986), and is positively associated with adherence (15). SE was measured with the uni-dimensional Dutch General Self-efficacy Scale (DGSS) (32), which consists of ten items on a 4-item Likert-scale (score 10-40). A higher score indicates better perceived self-efficacy. Internal consistency varies depending on the tested population (0.79 to 0.90), test- retest reliability coefficient is 0.50 and criterion, content and construct validity has shown population-related differences in diverse psychosocial constructs (33).

#### *Procedures of data collection*

After signing informed consent, participants filled in the baseline questionnaires (DGSS, PSOCQ, QBPDS, VAS) and demographic and clinical information (T0), and the therapists filled in part I of the UHEAQ. In the second week (T1) the physiotherapist measured adherence with part II of the UHEAQ during the session and participants filled in the PSOCQ after the session. The measurements of T1 were repeated in the sixth week of treatment (T2). To avoid measurement bias, clear instructions were given in a presentation and on paper for each physiotherapist, and a planning tool for T1 and T2 was provided.

#### **Data analysis**

Data was analysed with IBM SPSS Statistics, version 22. Patient characteristics and the demographics of the physiotherapists were analyzed using descriptive statistics. Missing measurements excluded from the particular analysis. Participants' were classified in a stage of readiness to change at baseline (T0) and follow-up assessments (T1 and T2). A mean score was calculated for the items measuring each stage, and the stage with the highest mean was used to classify the participant in one of the four stages (14). If the mean for two stages was equal, the participant was placed in the highest stage (14).

Adherence (average) at T1 and T2 was calculated for the whole sample and for each stage of change. The association between readiness to change at T0 and adherence to self-directed home exercises at T1 and T2 was explored using Relative Risk (RR) with 95% confidence interval (95% CI). Adherence was dichotomized as adherence (>60% performance) and non-adherence (<60% performance). A sensitivity analysis was performed at 40, 50 and 70% levels to test the robustness of the results. The hypothesis of an association between higher readiness to change and better adherence was tested with RR. Contemplation stage was compared to 1) Action and 2) to Action and Maintenance together, and  $RR > 1$  was interpreted as a higher chance for non-adherence. To explore the possible influence of other variables on non-adherence, RR was separately calculated for self-efficacy (below vs. above the group average), classification of the NSLBP (subacute vs. recurrent and chronic pain) and the referral type (direct access vs. referral).

## RESULTS

### Participants

Over a period of 17 weeks (February- June, 2014), 11 of the 25 physiotherapists managed to include patients, and their characteristics are summarized in table 1. In total 87 patients with LBP signed in for physiotherapy treatment in the participating practices. According to the eligibility, 41 patients were included and asked to participate and 17 declined due to various reasons (e.g. no time and/or interest). Finally 24 patients signed informed consent, but one patient was withdrawn after T0 due to severe head trauma, thus 23 patients were included in the analysis. In the second week (T1) three participants did not complete the PSOCQ and one missed the UHEAQ due to personal reasons. Three participants did not complete the last measurement (T2; either PSOCQ, UHEAQ or both) due to earlier termination of the treatment (e.g. sufficient recovery). The demographic and clinical characteristics of the participants are presented in table 2.

Table 1. Characteristics of the physiotherapists that included patients.

	Value
Gender (female; n)	5
Age	34,8 (24 - 49)
Clinical experience (years)	13,7 (3 - 27)
Specialization in Spine disorders	n=7
Manual therapy	3
MDT McKenzie	2
IAS (Sports) rehabilitation (Module Spine)	2
None	4

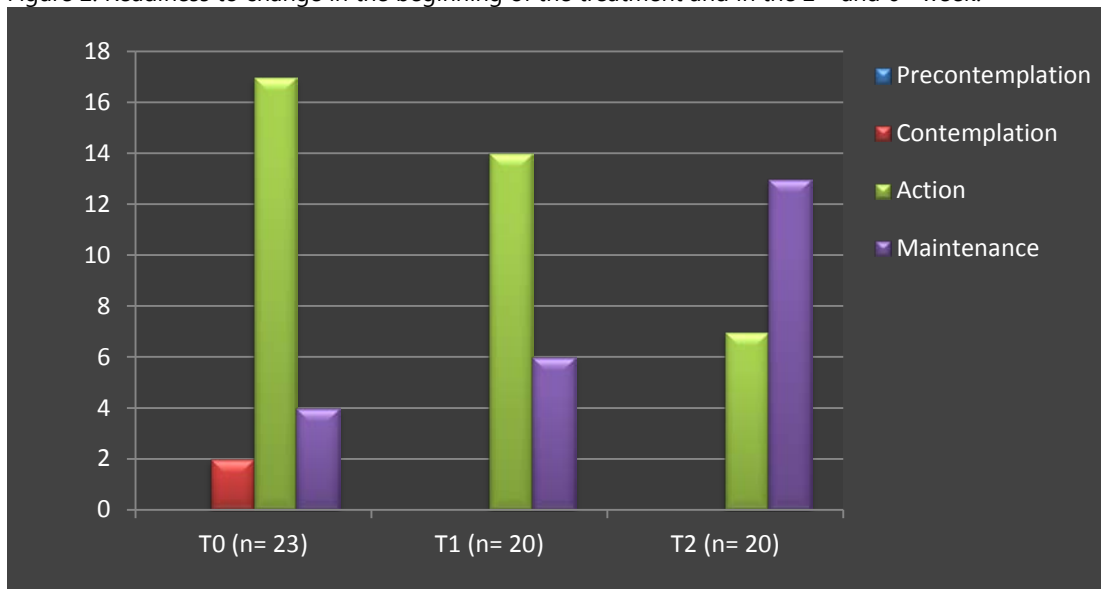
Table 2. Demographic and clinical characteristics of the study population (n=23).

	Value
Gender (female; %,n)	69.9% (16)
Age, (years; mean $\pm$ SD)	36.7 (12.1)
Type of admission (no referral; %, n)	56.5% (13)
Self-efficacy (DGSS; mean $\pm$ SD)	30.7 (3.7)
Pain (VAS; 0-100mm)	51.2 (20.3)
Duration of current episode LBP (weeks; mean $\pm$ SD)	14.2 (19.5)
The number of LBP episodes within last year (% ,n)	
First episode	34.8% (8)
2-5 episodes	39.1% (9)
> 5 episodes	26.1% (6)
Classification of NSLBP (% ,n)	
Sub-acute	47.8% (11)
Recurrent	26.1% (6)
Chronic	26.1% (6)
Limitations in activities (QBPDs; mean $\pm$ sd)	34.2 (15.4)
Type of work	
Sedentary	26.1% (6)
Physical	34.8% (8)
Combination	26.1% (6)
Work participation (% ,n)	
100%	65.2% (15)
50%	13.0% (3)
70%	4.3% (1)
0%	4.3% (1)

### Readiness to change

In the beginning of the treatment (T0) none of the participants was classified in the Precontemplation stage and only two in the Contemplation stage (8.7%). The majority was classified in the Action stage (73.9%, n= 17,) and four (17.4%) in the Maintenance stage. Although the majority already was classified in these 'higher' stages at baseline, a clear progression in readiness to change was still detected during treatment. Both participants initially in the Contemplation stage proceeded through Action (T1) to Maintenance (T2), and nine (39.1%) proceeded from Action to Maintenance. Classification of a participant in a 'higher' stage due to equal means for two stages occurred twice at baseline, once at T1 and three times at T2. The classification and progression through the stages is illustrated in figure 2.

Figure 2. Readiness to change in the beginning of the treatment and in the 2<sup>nd</sup> and 6<sup>th</sup> week.



### Adherence and association with readiness to change

Sample-based adherence and stage-based (T0) adherence at T1 and T2 are presented in table 3. Adherence to self-directed home exercises was on average 50.2% at T1 and 48.9% at T2. Comparisons based on the demographic and clinical features of the participants were made for adherence, but no significant differences were found. Association between readiness to change and adherence to self-directed home exercises was explored based on the initial stage of change. The relative risk for *non-adherence* in the second week was 60% higher for patients initially classified in the Contemplation, than for patients classified in the Action stage. When Contemplation was compared to Action and Maintenance grouped together, the RR for non-adherence was 50% higher for those classified in Contemplation stage. In the sixth week the RR remains similar (1.6) for both pairs. Table 4 summarizes the RR for non-adherence in the second and sixth week.

Table 3. Total sample and stage-specific adherence at T1 and T2.

(Sub)group and initial stage at T0	T1 Adherence >60% (n= 21)	T2 Adherence >60% (n= 20)
Total sample	30.4% (n=7)	30.4% (n=7)
Precontemplation (n= 0)	--	--
Contemplation (n= 2)	0.0%	0.0%
Action (n= 17)	37.7% (n=6)	35.3% (n=6)
Maintenance (n= 4)	25.0% (n=1)	50.0% (n=1)

Table 4. Relative risk (RR) for non-adherence based on the initial classification for readiness to change ('exposed' vs. 'non-exposed' group) at second and sixth week of treatment.

Stage of change (T0)	Relative risk (95% CI) 2nd week	Relative risk (95% CI) 6th week
Contemplation vs. Action	1.6 (1.2-2.3)	1.6 (1.1-2.2)
Contemplation vs. Action + Maintenance	1.5 (1.1-2.1)	1.6 (1.1-2.2)

### *Self-efficacy, referral type and classification of NSLBP*

No significant differences in adherence were found for subgroups concerning admission, classification of NSLBP and self-efficacy (table 5). However, *less* participants with higher SE than sample average (SE > 30.7) remained adherent at T2, while the number of participants with *lower* SE (< 30.7) did not differ between T1 and T2. The only unexpected difference in RR was found for self-efficacy at T2 (RR 0.5): participants with SE < 30.7 had reduced chance to be non-adherent (RR < 1).

### *Sensitivity analysis*

Sensitivity analysis resulted in similar results with 40, 50, 60 and 70%. There was no difference between 40 and 50% cut-off point in the number of adherent participants at T1 and T2. Lowering the cut-off point from 60 to 50% resulted in three adherent participants extra, the RR was similar and became slightly more significant (RR at T1; 1.8 and T2; 2.0). Raising the cut-off point from 60 to 70% resulted in a negative difference of two adherent participants while the RR remained stable (RR at T1,T2; 1.5). In total, the difference between 40 and 70% cut-off points was 5 participants.

Table 5. Adherence and Relative Risk (95%CI) for *non-adherence* based on the possibly confounding variables. Recurrent and chronic NSLBP (n=12) were grouped for the computation of the RR.

T0	T1	T1	T2	T2
Variable	Adherence > 60% (n=22)	RR (95%CI)	Adherence > 60% (n=20)	RR (95%CI)
Admission (referral)				
Yes (n= 10)	30.0% (n=3)	1.05 (0.6-1.9)	40.0% (n=4)	1.3 (0.4-4.5)
No (n= 12)	33.4% (n=4)		30.0% (n=3)	
Self-efficacy				
< 30.7 (n= 9)	55.6% (n=5)	1.0 (0.5-1.7)	55.6% (n=5)	0.5 (0.3-1.2)
> 30.7 (n= 13)	38.5% (n=5)		18.2% (n=2)	
Classification of NSLBP				
Sub-acute (n=10)	30.0% (n=3)	1.05 (0.6-1.9)	33.3% (n=3)	1.05 (0.6-2.0)
vs. Recurrent (n=6)	33.3% (n=2)		50.0% (n=3)	
+ Chronic (n=6)	33.3% (n=2)		20.0% (n=1)	

## DISCUSSION

The objective was to explore the relationship between readiness to change and adherence to self-directed home exercises in primary care population with NSLBP. The results indicate an existing relationship based on the significantly higher *relative risk for non-adherence* to self-directed home exercises for those in Contemplation stage, compared to patients classified in Action and Maintenance stages (RR 1.5-1.6). This result is supported by the study of Jensen et al., where Action and Maintenance were found to be associated with exercise and several active coping strategies (14). However, the distribution of the stages at baseline was skewed with hardly any patients in the lower two stages, and therefore this result should be interpreted with caution.

Most participants were expected to be classified in the Contemplation stage in the beginning of the treatment. This assumption was based on clinical experience and previous research in chronic pain samples (14,18), since no previous study on readiness to change has studied a sample in primary care physiotherapy. Precontemplation and Contemplation were hardly represented at baseline, while the majority was classified in Action and Maintenance stages (91.3%). This large group already seems to be open for self-management and new behavioral strategies. In contrast, those who are not ready for self-management (pre-contemplators and contemplators) and have different expectations regarding the intervention might preferably seek medical or (passive forms of) alternative care instead of entering physiotherapy.

The classification in stages, based on the PSOCQ, seems to be quite clear but as Habib et al. discovered, the individual could be in several stages simultaneously: in Action for considering stopping pain medication, and in Contemplation for starting home-exercises (14,35). This

finding, together with previous literature on PSOCQ, suggests that the classification of the individual in one stage might not be sufficiently discriminative (35,36). Furthermore, the items of the PSOCQ might not be specific enough to reflect the construct that is being measured (39), in this case readiness to self-directed home exercises. Addition of items reflecting an active role towards home exercises might improve the validity of the PSOCQ as a predictor of adherence to (home) exercise therapy.

Based on the previous assumption of the majority in the Contemplation stage, adherence was not expected to be high, but nevertheless better for those with higher readiness to change. However, in the second and sixth week only 35.0% (n=7, the same participants) had performed more than 60% of the total exercise volume prescribed. The sensitivity analysis showed that lowering the cut-off point from 60% to 50% would result in a positive difference of three participants. However, it would not change the overall tendency of the adherence results, and since most participants were expected to give somewhat social approved answers, 60% cut-off point was retained. Previous research on adherence has found that complexity and the number of exercises (37), difficulties of fitting them in the daily routine (37,38), insufficient argumentation and instruction (37) and low expected/experienced effect (13,34) are known to influence individuals' motivation to exercise. Moreover, when pain and disability decrease (due to any reason), motivation to exercise diminishes. However, higher levels of pain during exercising and the use of pain medication might have a similar effect, both leading to (partial) non-adherence to home-exercises. In the current study the highly self-efficacious participants were somewhat less adherent at T2, which can be interpreted as confidence to choose whether the home-exercises were effective thus worth performing, whereas less self-efficacious participants tended to keep on exercising as prescribed. On the other hand, Oliveira et al. reported that in order to find the (home) exercises worth the effort, patients with external locus of control need to belief in a higher improvement percentage following motor control exercises in order to be adherent (34).

Although a significant association between readiness to change and adherence was found, the results indicate that adherence to home exercises cannot be predicted based on a high stage of change alone. Namely, the majority of the participants were classified with higher readiness to change, while the majority also appears to be non-adherent. These results raise the question about what the missing link could be. A promising model focusing on this *intention-behavior gap*, The Health Action Process Approach (HAPA; Schwarzer 1988), describes a two-phase process of behavioral change in rehabilitation (39,40). In the motivational phase an *intention to adopt new behavior* is initiated, followed by the volitional phase where the *intention is translated into action*. Identification of the Preintenders (motivational phase), Intenders and Actors (volitional phase) assists in choosing the right *supportive* intervention, such as *Action and Coping Planning*, as a tool to bridge the gap between intention and behavior. For the Intenders who have difficulties in translating intention into action, incorporation of *Action Planning* within exercise therapy might be of

added value to increase adherence. For Actors who already perform new behavior, a *Coping Plan* as preparation for situations with risk for relapse might help to sustain the required behavior as long as needed in order to reach targeted treatment outcome and prophylaxis. Also Broonen et al. have identified and discussed volition as a missing link between motivation and action in patients with LBP (42). Future research on the HAPA and, as Broonen et al. suggest, the action planning (specifying when, where and how the action takes place) might be useful in improvement of adherence in individuals with LBP.

There are some limitations in this study. First, the application of PSOCQ in primary care for measuring readiness to adopt home exercises might be influenced by the fact that PSOCQ is developed for chronic pain populations to predict engagement in behavioral treatments. Furthermore, the items of the PSOCQ might not be specific enough to reflect the construct that is being measured (35), in this case readiness to self-directed home exercises. Second, despite all recruitment efforts, the sample size was too small for more powerful statistic inferences for association and interaction analysis. Relative risk was used, but the skewed distribution of the initial stage of change might bias the results, and correction for potential confounders or interaction of other variables (e.g. SE) was not possible. Third, the measurements were not always conducted as scheduled due to patient- depending reasons, possible resulting in measurement bias. However, there were no differences in adherence between the second and sixth week.

This study is the first application of the PSOCQ in primary care sample with NSLBP, creating a new insight in readiness to change in this population. It suggests that individuals entering physiotherapy are already open for adopting new behavior and self-management. Together with the adherence results it is an important finding, indicating that home-exercises in general do not seem to be of extra value from the patients perspective. Further research on better targeted and clear instructed exercises that are less time consuming and more attractive to perform is recommended. Moreover, more research is needed on complementary theories, such as the HAPA, to bridge the gap between intention and a new behavior and to improve adherence to home-exercises within physiotherapy.

## **CONCLUSION**

TTM-based readiness to change was relatively high in the studied primary care population, implying that patients are taking actively part in self-management and behavioral change. Although 'lower' readiness to change seems to be associated with higher chance for non-adherence to self-directed home exercises, the number of adherent patients with high readiness to change remains low. Implementation of the Action and Coping Planning in self-management could be further studied in order to improve adherence to self-directed home exercises.



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