AUS DEM INSTITUT FÜR GESUNDHEITSWISSENSCHAFTEN

FACHBEREICH PHYSIOTHERAPIE

Direktorin: Prof. Dr. Kerstin Lüdtke

_____

THE FACILITATION OF ADHERENCE IN PATIENTS WITH NON-SPECIFIC BACK PAIN TO PHYSIOTHERAPY

Inauguraldissertation

zur

Erlangung der Doktorwürde

der Universität zu Lübeck

- Aus der Sektion Medizin -

vorgelegt von

Andreas H. Alt

aus Nürnberg

Lübeck 2024

Table of Contents

List of Figures

List of Abbreviations

Abbreviation	Complete definition
AESOP	Adherence to Exercise Scale for Older Patients
GMA	German Medical Association (deutsch: Bundesärztekammer)
BMC msk	BioMed Central musculoskeletal
B.Sc.	Bachelor of Science
CBT	Cognitive behavioral therapy
CHAMPS	Community Healthy Activities Model Programme for Seniors and Pittsburgh Rehabilitation Participation Scale
COU	Counseling
DBT	Digital based tools
Dipl.	Diploma
EARS	Exercise adherence rating scale
ELC	External locus of control
GL	Guideline
HRERS	Hopkins Rehabilitation Engagement Rating Scale
HP	Home program
ILC	Internal locus of control
JBMT	Journal of Bodywork and Movement Therapies
JMMT	Journal of Manual and Manipulative Therapies
LBP	Low back pain
M.Sc.	Master of Science
MT	Manual therapy
NSLBP	Non-specific low back pain
PG	Patients group
PT	Physiotherapy
PTG	Physiotherapists group
RAQ	Rehabilitation adherence scale
RCT	Randomized controlled trial
SIRAS	Sports injury rehabilitation adherence scale

1. Introduction

This cumulative dissertation consists of three projects, which are presented in the following. The information in the background section is related to the overarching topic of *"Facilitation of adherence in patients with low back pain to physiotherapy"*. Specific background contents, relevant for the respective studies, were defined separately in the individual sections on studies 1-3.

The first publication is a systematic review entitled *"Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy – a two stage systematic review"*. In this review, two research questions were defined:

(1) "What tools are used to measure adherence to physiotherapy in patients with low back pain?"

(2) "What is the most effective strategy to improve adherence of patients with low back pain?"

The results subsequently prompted a qualitative research project entitled *"How do non-specific back pain patients think about their adherence to physiotherapy, and what influences the strategies used by physiotherapists to facilitate adherence?"*
This qualitative focus group study provided answers to the questions:

(1) "How do patients with low back pain think about the realization of physiotherapy programs, which are generally perceived as a kind of obligation?"

(2) "How do physiotherapists think about performing their tasks that could influence adherence to physiotherapy in low back pain?"

To further define the findings from the previous studies, a Delphi study entitled *"Which aspects facilitate the adherence of patients with low back pain to physiotherapy?"* was subsequently implemented. This Delphi study aimed *to identify an expert consensus on aspects facilitating the adherence of patients with back pain to physiotherapy*.

In the following, the individual studies are presented first as extended abstracts and then in detail as original publications in the attachments.

1.2 Scientific background on adherence to physiotherapy

Managing low back pain (LBP) is a multidimensional treatment process addressing cognition, function, and pain to reach long-lasting effects and reduce the risk of chronification (George et al., 2021; Grabovac et al., 2019; Hayden et al., 2019). Long-term effective pain management requires self-management (Nkhata et al., 2019; Grabovac et al., 2019) and self-management relies on the patients' level of adherence (Kongsted et al., 2021).

Adherence has been defined as *"the extent to which a person's behavior conforms to the agreed-upon recommendations of a healthcare provider"* (WHO, 2003). According to the findings of some researchers, confounding between adherence and compliance has been noted in physiotherapy (PT) (McLean et al., 2017). Compliance was defined as "a patient following the advice of a therapist or physician" (Gray et al., 2002), while adherence means the willingness of patients to follow treatment recommendations agreed upon with the therapist to the best of his or her ability and empathy (McDonald et al., 2002). In PT, the concept of adherence is multidimensional and based on biopsychosocial influences (Jack et al., 2010; Kolt & McEvoy, 2003) (Figure 1).

According to national care guidelines, a patient with back pain should perform regular physical exercises, avoid prolonged periods of rest, and avoid long-term passive therapy measures such as manual therapy (MT) and other soft tissue treatments (GMA et al., 2017; Oliveira et al., 2018). This already implies that patient adherence to PT can be a major effort far beyond e.g., taking medication (Sarbacker & Urteaga, 2016, Room et al., 2021). The term emphasizes the concordant behavior of patient and physician (McDonald et al. 2002; Chakrabarti, 2014) and thereby exceeds compliance (Gray et al., 2002).
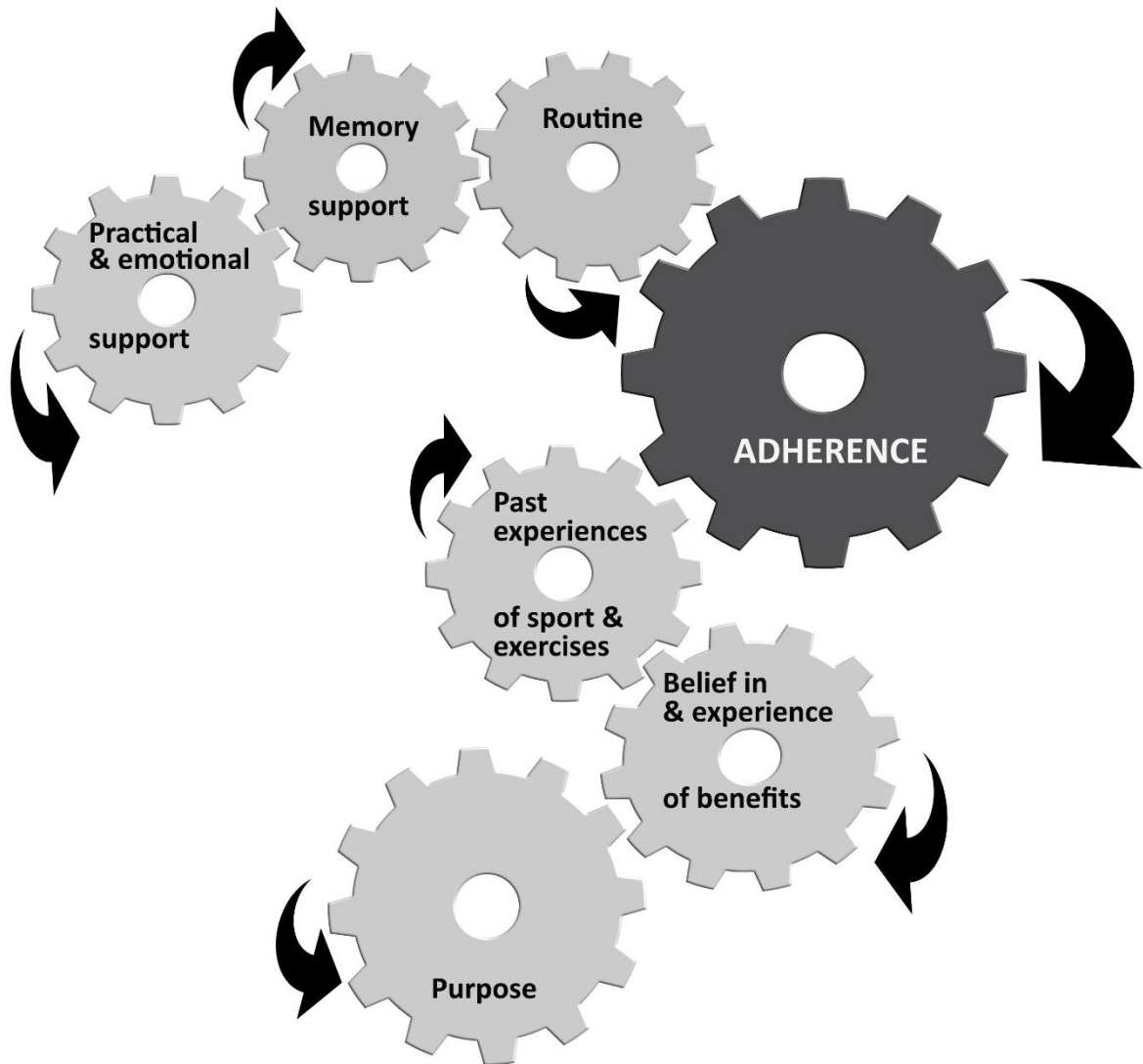
Figure 1 The influences on adherence

This Figure shows the complexity of how adherence works based on the individual elements playing a role. The psychological and multidimensional approach become apparent (Hancox et al., 2019).

2.1 The biopsychosocial approach related to adherence

Factors such as motivation, support from the social environment, experiences, beliefs, intensity of pain or disability are examples for factors influencing adherence and describe the biopsychosocial nature of adherence (Epker & Gatchel, 2000). Furthermore, patient adherence does not depend exclusively on aspects that can be directly influenced, such as the practicability of exercises or the comprehensibility of explanations regarding their necessity, but also on personal aspects, such as the level of education (Areerak et al., 2021).

Important information about how to facilitate adherence can be derived from the identification of barriers, which include difficulties in contacting healthcare providers, lack of motivation and supportive environment, lack of self-discipline or time, forgotten exercises, difficult or non-effective exercises, patients' beliefs, therapist-patient relationship, patient involvement, patient attitudes, cultural aspects, and language (Boutevillain et al., 2017; Cherkin et al., 2016; Lonsdale et al., 2017; Martin et al., 2005; Palazzo et al., 2017).

In other studies, the locus of control (LOC) has also been shown to influence adherence with biopsychosocial factors (Brincks et al., 2010; Omej and Nebo, 2011). The internal locus of control (ILC) means in PT that a patient is motivated to perform exercises and accept the recommendations of the physiotherapist (Omej and Nebo, 2011; Sengul et al., 2010). The rehabilitation is primarily controlled by the patient himself (Omej and Nebo, 2011; Sengul et al., 2010). The external locus of control (ELC) represents the expectation of patients to avoid self-responsibility and active treatment approaches, which could increase the risk of a PT dependency. The PT dependence subsequently put the patient at risk for chronicity of symptoms, making rehabilitation more difficult and more expensive (Álvarez-Rodríguez et al., 2022). The rehabilitation of patients with ELC is primarily controlled by others, e.g., physiotherapists (Omej and Nebo, 2011; Sengul et al., 2010).

2.2 Aspects that influence adherence

The quality of adherence, which is often referred to quantitatively as the level of adherence, can be influenced by various aspects such as contacting care providers, level of motivation and supportive environment, self-discipline or time, exercises acceptance, a reminder of exercises and programs, effectiveness of exercises, patients' beliefs, the therapistpatient relationship, patient involvement, patient attitudes, cultural aspects, and language (Boutevillain et al., 2017; Cherkin et al. 2016; Lonsdale et al., 2017; Maas et al., 2015; Martin et al., 2005; Palazzo et al., 2017). In addition, studies provide evidence for the use of patient motivation strategies and graded exercises to improve treatment adherence in people with chronic non-specific low back pain (CNLBP). However, effect sizes for these interventions decline over time until they are moderate at best in the long term (Nicolson et al., 2017). While patient-related factors, such as educational background, can potentially

not be influenced. They can be assessed and may be relevant in the choice of strategy to facilitate adherence (George et al., 2021; Grabovac et al., 2019; Hayden et al., 2019).

2.3 Competencies of physiotherapists to facilitate adherence

The competency criteria are initially based on confidence in the need to implement measures to facilitate adherence in the shortest possible time, e. g. guideline-oriented practice or communication skills (Babatunde et al., 2017; Lemmers et al., 2022; Lonsdale et al. 2017; Maas et al., 2015, Peek et al., 2017). Options to facilitate adherence should therefore include psychological strategies, such as motivation or self-awareness, and education to understand the need for therapeutic and medical measures (Bell et al., 2007; De las Cuevas, 2011), but also exercise-related strategies such as the appropriate difficulty or intensity of exercise programs and the implementation of reminders (McLean et al., 2017; Mallett et al. 2020).

2.4 Measuring adherence of patients with low back pain

For the measurement of adherence in back pain patients, relevant for this dissertation, the Exercise Adherence Rating Scale (EARS), and the Sports Injury Rehabilitation Adherence Scale (SIRAS) remain interesting, as they are not assigned to any specific patient group, such as seniors or athletes.

EARS contains 17 items and is scored on a 5-point Likert scale (0-4, completely agree to completely disagree), with a higher score indicating stronger adherence. The theoretical maximum number of points is 68. The questionnaire should be evaluated and interpreted by the physiotherapist.

The SIRAS contains three items with five rating option each. It can be interpreted selectively per item (1 = minimum level of adherence, 5 = highest level of adherence) or combined with a total score of all three items (3 = minimum level of adherence, 15 = highest level of adherence).

There are different approaches to measure adherence in PT. Mallett et al. (2020) identified in their study that specific assessment of adherence to PT should focus on

(1) **relevance:** are there therapeutic benefits, e.g., faster recovery, better self-management, or cost savings when patient adherence is measured in detail?

(2) **Feasibility:** are sufficient resources (instruments, e.g., questionnaires, time, etc.) to measure adherence in as much detailed as is feasible at best?

(3) **Acceptability:** is the patient's understanding and acceptance sufficiently available to measure adherence detailed enough to achieve the best therapeutic outcome?

(4) **Appropriateness**, or

(5) **overall suitability:** is each patient case analyzed individually for its characteristics to determine if and what type of adherence measurement is relevant?

The studies of McLean et al. (2017) and Mallett et al. (2020) extracted six questionnaires that can be used specifically for adherence to PT:

- Exercise Adherence Rating Scale (Newman-Beinart et al., 2017)
- Rehabilitation Adherence Questionnaire (Shin et al., 2010)
- Hopkins Rehabilitation Engagement Rating Scale (Mayhew et al., 2019)
- Community Healthy Activities Model Program for Seniors and Pittsburgh Rehabilitation Participation Scale (Mallett et al., 2020)
- Adherence to Exercise Scale for Older Patients (Hardage et al., 2001)
- Sports Injury Rehabilitation Adherence Scale (Bollen et al., 2014)

Evidence of specific and valid measurement of adherence to different methods in the context of PT, not just exercise or movement, appears inadequate (Peek et al. 2019). From previous research it is not sufficiently clear

- how to facilitate adherence in patients with LBP to PT, and
- what criteria are needed for specific therapy to facilitate adherence of patients with LBP to long-term effective PT?

To answer these questions, three research projects were conducted from November 2021 to April 2023. The initial project was a two-stage systematic review followed by a focus group study based on a qualitative research approach. The research process was concluded with a Delphi survey.

1. Extended abstract of Study 1

Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy - a two-stage systematic review

Authors: Alt, A.[1]; Luomajoki, H.[2]; Luedtke, K.[3]

[1] Ph.D. student, University of Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562 Lübeck

[2] Second supervisor, Zürich University of Applied Sciences, Institute of Physiotherapy, Katharina Sulzer Platz 95, 8401 Winterthur

[3] First supervisor, University of Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562 Lübeck

Notification about copyrights

Background

Managing LBP is a multidimensional treatment process addressing cognition, function, and pain to reach long-lasting effects and reduce the risk of chronification. Long-term effective pain management requires self-management and self-management relies on the patients' level of adherence. For self-management in musculoskeletal disorders, such as NSLBP, where adherence to exercises is particularly important for symptom rehabilitation, several factors have been reported that keep patients engaged. These include confidence in the recommended exercises, individualization, scope of a program (design, ease of use), social support, self-efficacy, and smooth integration of exercises into daily life. Sufficient consideration of patients' preferences and backgrounds, as well as accessibility and flexibility of treatment programs, support adherent behavior approaches. However, to date, no specific tool is recommended for the adherence assessment of patients with NSLBP to PT.

Equally, no recommendation is currently available for a strategy to be used by physiotherapists to facilitate adherence of patients with NSLBP. The objectives of this two-stage systematic review were to identify

(1) tools to measure adherence of patients with LBP to PT and

(2) the most effective strategy to facilitate adherence of patients with LBP to PT.

Method

This review follows the recommendations from the Cochrane handbook for systematic reviews to answer the question on the strategies and their effectiveness to facilitate adherence and is reported based on the guidelines by PRISMA for scoping reviews (question one) and systematic reviews (question two).

Since most studies which were designed to evaluate a strategy to facilitate adherence also measured its effect, the literature search was combined for both questions. Inclusion criteria were randomized controlled trials (RCT), controlled trials (CT) or observational studies, and cohort studies reporting on adult patients suffering from LBP, currently receiving PT treatment. Studies had to either report a strategy to facilitate patient adherence or a primary or secondary outcome measure for patient adherence.

PubMed, Cochrane, PEDro, and Web of Science databases were used for the systematic searches. Hand searching in literature lists of included articles was added to receive further

relevant results. The data of the included full-text publications were extracted in pre-specified data extraction tables for stage one and stage two. Effects were shown as differences between the intervention and control group, presented as percentage change.

Results

A total of 293 single studies were initially identified from all databases and 214 articles were selected for title and abstract screening. 119 eligible articles from all databases were retrieved for a full-text assessment. In total we identified 21 single studies that were initially relevant for stage one and/or stage two. Of these, 21 studies were used for stage one and 16 for stage two. Furthermore, 16 studies reported on the effectiveness of strategies to enhance adherence of patients with LBP (Figure 2).
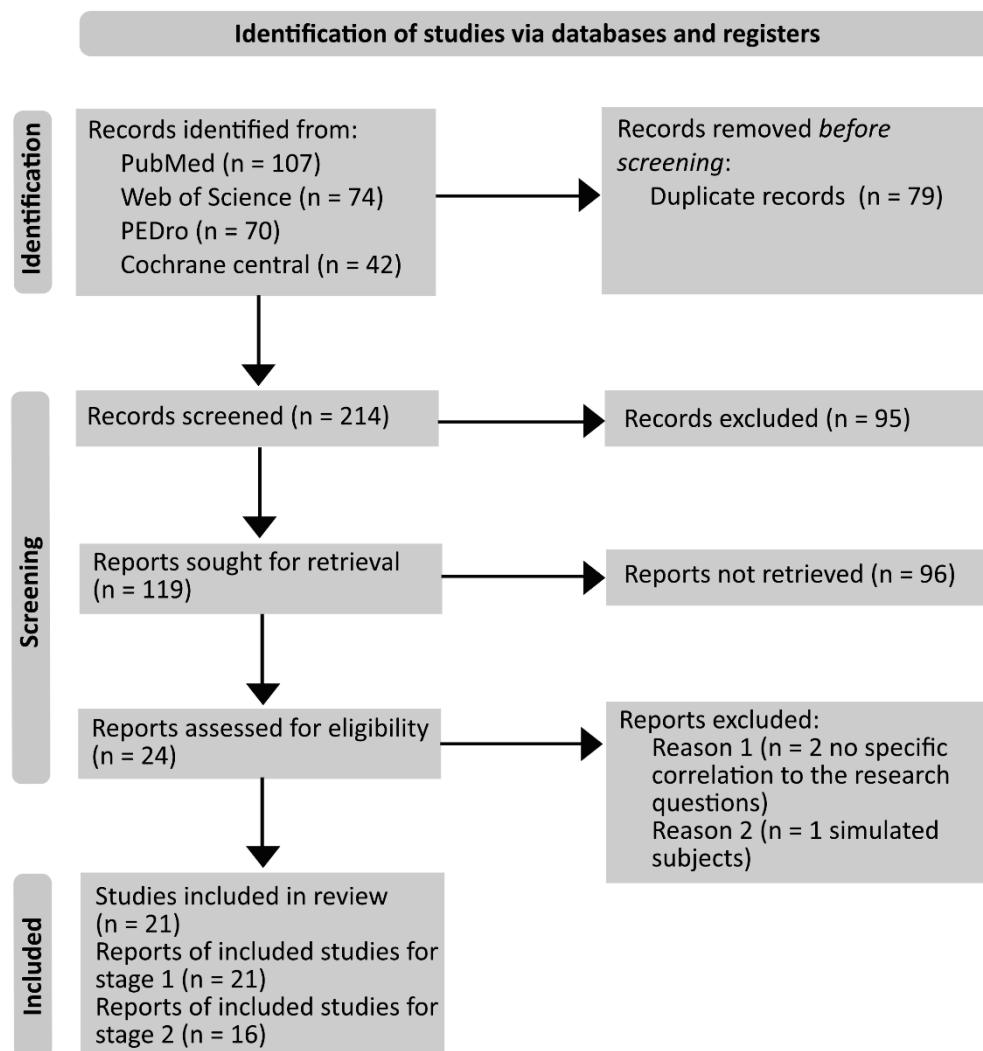
Identification of studies via databases and registers

Identification

Records identified from:
    PubMed (n = 107)
    Web of Science (n = 74)
    PEDro (n = 70)
    Cochrane central (n = 42)

Records removed *before screening*:
    Duplicate records (n = 79)

Screening

Records screened (n = 214)

Records excluded (n = 95)

Reports sought for retrieval (n = 119)

Reports not retrieved (n = 96)

Reports assessed for eligibility (n = 24)

Reports excluded:
    Reason 1 (n = 2 no specific correlation to the research questions)
    Reason 2 (n = 1 simulated subjects)

Included

Studies included in review (n = 21)
Reports of included studies for stage 1 (n = 21)
Reports of included studies for stage 2 (n = 16)

Figure 2 Study identification for systematic review

The PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement, published in 2009, is intended to help authors of systematic reviews report transparently why the review was conducted, what the authors did, and what they found (Page et al., 2021).

Stage one identified the SIRAS as the most used multidimensional questionnaire to measure adherence in LBP populations. Even more frequently used were exercise or therapy diaries or protocols to document the number of practiced sessions. Reports or interviews, such as questions to evaluate adherence of patients to exercises or PT programs were used by five studies. In addition, six studies used a combination of tools. These tools were primarily directed to quantify motivation, satisfaction, behavioral regulation, quality of life, and fear of movement as the specific criteria that the authors correlated with patients' adherence to PT sessions.

Stage two shows the strategies and their effectiveness to facilitate adherence to PT. Of 16 single studies applying a strategy, only 11 reported on its effectiveness by measuring adherence (and not exclusively clinical improvement).

Most frequently (six studies) evaluated were strategies that can be summarized as counseling strategies (COU) and three cognitive behavioral therapy (CBT) Introducing specific communication styles was another strategy used successfully to enhance adherence. In three studies digital based tools (DBT) were used in their respective groups, also facilitating adherence.

Conclusion

The current review reveals a gap in the evidence on strategies to facilitate adherence in NSLBP populations and measurement tools that reach beyond the counting of exercise sessions.

The aim of future work should be to develop strategies and test their effectiveness on patient adherence, especially in patients with NSLBP. This should include but not be limited to digital options. Furthermore, measurement tools need to be evaluated for psychosocial properties that focus specifically on patients with back pain, are easy to use clinically, and incorporate the multidimensional aspects of adherence.

3. Extended abstract of Study 2

How do non-specific back pain patients think about their adherence to physiotherapy, and what strategies do physiotherapists use to facilitate adherence? A focus group interview study

Authors: Alt, A.[1]; Röse K.[2], Luomajoki, H.[3]; Luedtke, K.[4]

[1] Ph.D. student, University of Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562 Lübeck

[2] Expert in qualitative research, University of Lübeck, Institute of Health Sciences, Department of Occupational Therapy, Ratzeburger Allee 160, 23562 Lübeck

[3] Second supervisor, Zürich University of Applied Sciences, Institute of Physiotherapy, Katharina Sulzer Platz 95, 8401 Winterthur

[4] First supervisor, University of Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562 Lübeck

Background

The multidimensional treatment process of patients with LBP is based on addressing cognition, function, and pain to reach long-lasting effects and reduce the risk of chronicity. The level of program adherence is essential for the long-term management of non-specific musculoskeletal pain. For the self-management of patients, a high level of adherence is needed.

Current evidence supports that patient adherence can be influenced positively and negatively and that different treatment strategies may have different effects on adherence. In a previously conducted systematic review, our workgroup found that no tools for the measurement of adherence exist, which capture its multidimensional nature. The multidimensionnal measurement is based on the biopsychosocial approach, such as the motivation of the patients, their trust in the PT, and the quality of the therapist-patient relationship, but also the comprehensibility of the exercises, enough appointments, etc. A specific strategy to facilitate adherence in patients with LBP is based on the high relevance of psychosocial factors in back pain and expertise appropriate for LBP. In other studies, the LOC has also been shown to influence adherence.

This focus group study aimed

    (1) to identify aspects associated with the adherence of patients with LBP to PT, and

    (2) to identify factors to facilitate adherence of patients with LBP to PT.

Method

Focus group interviews based on a qualitative research approach were chosen to explore the perspectives of patients with LBP and physiotherapists. For study development, we used the COREC checklist.

Qualitative research was used because there was a lack of sufficient research on this topic. The focus group discussion allows for group dynamics that can lead to clarification of individual arguments, opinions, beliefs, and expectations that can be beneficial to understanding the research subject. For this purpose, a total of two focus groups were formed, consisting of either physiotherapists (PTG) (n = 11) or patients with LBP (PG) (n = 10). The interviews were semi-structured and followed a predesigned interview guide. Data analysis was based

on structured content analysis. Deductive and inductive categories were identified and coded (Figure 3).

Descriptive Method
Structured content analysis

↓

Sampling:
Participants of different centers
Setting of contrasts

↓

Focus group discussions:
Two groups of patients with LBP (n = 10)
Two groups of physiotherapists (n = 11)

↓

Data conducting:
Guided interviews
Computer assisted transcription

↓

Data analysis:
Categorizaton and coding of deductive
and inductive categories

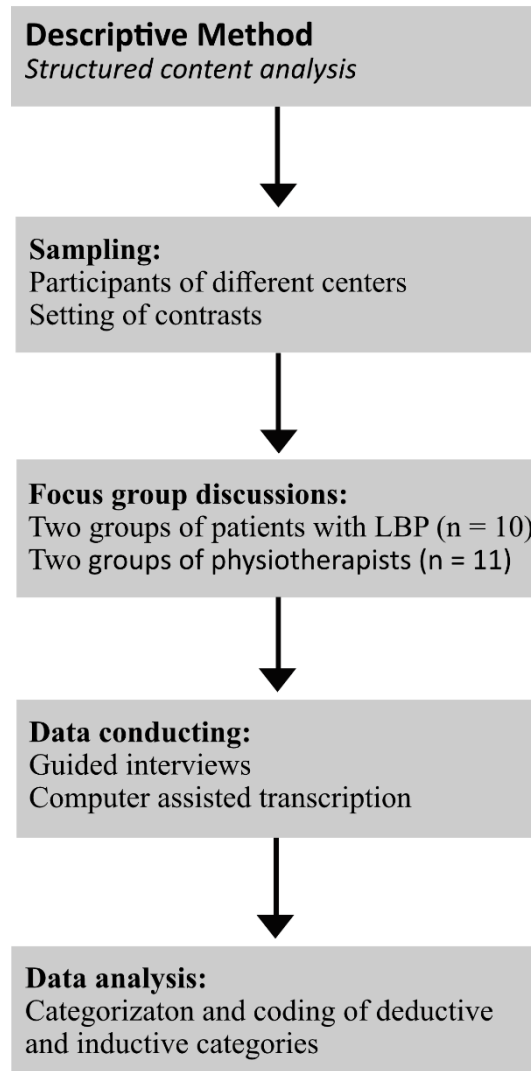**Figure 3** Methodology of the focus group study

This Figure illustrates the methodological process. LBP = low back pain, n = number of individuals

Results

In the PG (n = 10, 5 women), eight patients had recurrent back pain, one had a duration of pain of more than six months and one had back pain for less than one month. Five patients worked in an office, two were employees. The average age was 37.5 years.

Overall, there was almost homogeneous participation (all participants answered all questions). There were rarely contradictions among the participants but sometimes additions were offered to the answers and experiences of one or more participants.

Patients with LBP requested more and effective home programs, long-term rehabilitation management, and individualized therapy to achieve a higher level of adherence.

In the PTG (n = 11, 5 women), the participants had an average experience of treating patients with LBP of more than eight years. Five had an academic degree, all worked in a private PT center and the average age was 33 years. All participants engaged in the discussion. There was often agreement on responses and a high level of expertise was demonstrated because all answers indicated a good knowledge of patient adherence

Physiotherapists requested more time for patient education. Communication, quality of the therapist-patient relationship, and individualized therapy were identified as essential factors by both representatives.

Conclusion

Patients with LBP requested individual, goal-oriented, and long-term care. They expected HP and physiotherapists who take their problems seriously. Physiotherapists treating patients with LBP were interested in developing self-management and active therapy strategies. They reported conflicts with other medical actors, such as general practitioners or colleagues, restricting the implementation of behavioral change strategies for patients with LBP. Physiotherapists described communication, patient education, and attention to patient reports as essential aspects of adherence facilitating PT. Future research should specify the components for optimized adherence in patients with LBP and focus on the development of outcome measures for adherence.

4. Extended abstract of Study 3

***Which aspects facilitate the adherence of patients with low back pain to physiotherapy?
A Delphi study***

Authors: Alt, A.[1]; Luomajoki, H.[2]; Luedtke, K.[3]

[1] Ph.D. student, University of Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562 Lübeck

[2] Second supervisor, Zürich University of Applied Sciences, Institute of Physiotherapy, Katharina Sulzer Platz 95, 8401 Winterthur

[3] First supervisor, University of Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562 Lübeck

Notification about copyrights

Background

According to national and international clinical guidelines, a patient with LBP attending PT is advised to perform regular physical exercises, avoid prolonged periods of rest, and long-term passive therapy measures such as MT or massage. The long-term effects of LBP treatment depend on a complex process addressing cognition, function, and pain. This can be achieved by PT approaches that facilitate patient self-management and require a high level of adherence.

In a previously conducted focus group study, investigating the perspectives of patients and of physiotherapists, aspects influencing the adherence of patients with LBP were shown to be more complex than expected. Patients requested long-term rehabilitation management, individualized therapy, and effective home programs to achieve a higher level of adherence. Physiotherapists requested more time for patient education. They indicated that adherence to PT in patients with LBP can be negatively influenced by the advice or expectations induced by other healthcare professionals. Physiotherapists and patients agreed that communication, the quality of the therapist-patient relationship, and individualized PT are essential factors facilitating adherence.

Following these findings, this Delphi study aimed to identify a consensus of experts on adherence-facilitating aspects. The results of the Delphi study are intended to improve the understanding of how to facilitate adherence in patients with LBP to subsequently develop and evaluate targeted treatment strategies.

Method

International experts were invited to participate in a three-round standard Delphi survey. The survey contained 49 items (32 original and 17 suggested by experts) which were rated on 5-point Likert scales. The items were assigned to six domains. The consensus level was defined as 60 % (Figure 4).
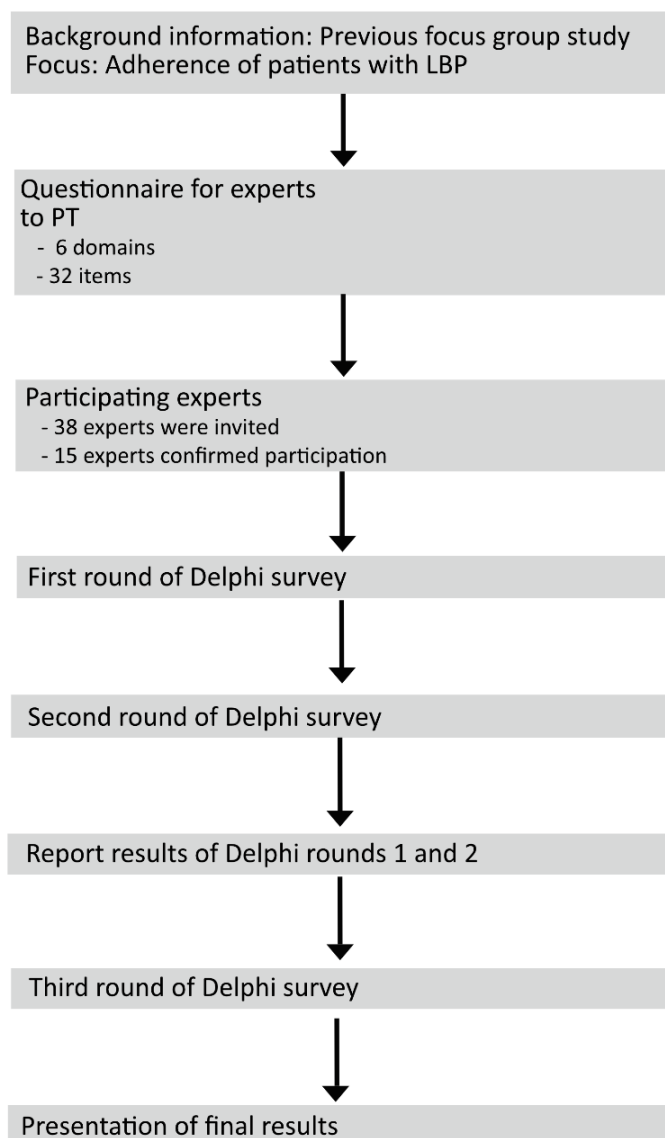
Figure 4 Methodology of the Delphi study

This figure shows the different steps of the methodological process. It started with the review of the previous projects included in this dissertation and the correspondent background literature and ended with the report of the Delphi results. LBP = low back pain, PT = physiotherapy

The technique of purposive sampling was used to select informed individuals to serve on a panel of experts for the Delphi process. The experts were identified through a previously conducted systematic review aiming to identify tools to measure and evaluate the effectiveness of strategies to facilitate adherence in patients with LBP.

The responses from each Delphi round were entered into a Microsoft Excel spreadsheet. To determine the consensus to include, the number of "absolutely correct" and "correct" ratings were counted and presented as a percentage of all ratings. In addition, open

questions were asked in the first round for each dimension, which the experts could optionally answer. The answers of the experts to the open questions were converted into new items and presented to experts to be rated in the second round.

Results

Of 38 invited experts, 15 followed the invitation and completed all three rounds. A positive consensus was reached on 62 % of the 49 proposed items to facilitate adherence. The highest consensus was achieved in the domains "Influence of biopsychosocial factors" (89 %) and "Influence of cooperation between physiotherapists and patients" (79 %). Additional important domains were the "Influence of competencies of physiotherapists" (71 %) and "Interdisciplinary congruence" (78 %). "Administration aspects" and the "Use of digital tools" did not reach expert consensus.

Conclusions

Biopsychosocial aspects, implemented into PT treatment, but also the competencies of physiotherapists, interprofessional congruence, and the patient-therapist relationship were seen as important aspects to influence adherence. The use of digital tools could facilitate adherence if designed to meet the individual needs of patients. Whether administrative aspects influence adherence is unclear. Longitudinal studies evaluating the effect of using the identified items are required to assess whether patient adherence can be influenced using these strategies and which strategy results in the best outcomes.

5. Overall conclusio

The three studies conducted sequentially, provided a deeper understanding of the complexity of adherence in patients with LBP to PT. The focus was on measuring and facilitating adherence as comprehensively as possible to enable long-term effective PT.

The first presented systematic review showed that the tools used to measure adherence were mostly one-dimensional and quantitative, e.g., counting the number of exercises sessions performed by the patient (nine studies) (Chapter 8 *Attachments*). Multidimensional tools for measuring adherence, such as EARS or SIRAS, were rarely used. Other approaches included patient satisfaction assessments which revealed a specific aspect of psychological influence on adherence in patients with LBP (Peek et al., 2019; van Tilburg et al., 2020).

The SIRAS was the most common multidimensional oriented tool in four studies (Coppack et al., 2012; Hügli et al., 2015; Lonsdale et al., 2017; Mannion et al., 2009), followed by 4-5-point Likert adherence scales in two studies (Peek et al., 2019; van Tilburg et al., 2020), and the multidimensional adherence index in one study (Mannion et al., 2009). The most comprehensive approach, as chosen by six studies was a combination of measurement options (Coppack et al., 2012; Lonsdale et al., 2017; Mannion et al., 2009; Ris et al., 2021; Van Tilburg et al., 2020; Verbrugghe et al., 2018). Thereby, information was collected on a spectrum of potential psychosocial influences on adherence.

The most effective strategy to facilitate adherence could not be identified because of the multitude of approaches including their duration and frequency, the type of intervention, and non-comparable measurement tools. Approaches based on psychological strategies, such as COU (Alzahrani et al., 2021; Azevedo et al., 2021; Basler et al., 2007; Lenoir et al., 2020; Taulaniemi et al., 2020; Wälti et al., 2015) and CBT (Göhner and Schlicht, 2006; Jay et al., 2015; Kerns et al., 2014), strategies based on communication, e.g., goal setting, motivation, and changing negative beliefs by developing a coping strategy (Kolt and McEvoy, 2003; Jack et al., 2010; WHO, 2003; Collado-Mateo et al., 2021; Bachmann et al., 2018; Essery et al., 2017; Ritschl et al., 2020) were the most frequently evaluated strategies. Only Lonsdale et al. (2017) used specific communication styles and achieved a 41 % higher adherence in the group with COM.

To achieve a clearer understanding of the aspects that influence the adherence of patients with back pain multidimensionally, a focus group study was subsequently conducted (Chap-

ter 8 *Attachments*). This study identified adherence-influencing aspects from the perspectives of patients and physiotherapists. The main requirements of patients were that physiotherapists should provide a HP that is individualized, goal-oriented, and controlled. A main concern was not receiving sufficient PT sessions due to health system requirements in Switzerland and Germany. In these countries, PT sessions are prescript by physicians and every prescription allows a maximum of six (Germany) to nine (Switzerland) sessions.

In general, the level of adherence to PT and HP seemed to be higher in patients with more acute pain. Physiotherapists confirmed some of the aspects proposed by the patients. They agreed that time is a limiting factor, and that time-consuming bureaucracy can be a barrier to evidence-based methods, such as pain education and personalized HP.

Previous publications showed factors influencing adherence from the perspective of physiotherapists in terms of communication skills, knowledge on how to facilitate behavior change, and motivation (Babatunde et al., 2017; Lemmers et al., 2022; Maas et al., 2015, Peek et al., 2017). A new aspect was that other healthcare professionals might raise false expectations about PT, making patient behavior changes unnecessarily complicated. In contrast to the findings from other studies (Coppack et al., 2012; Lemmers et al. 2022; Lonsdale et al., 2017; Maas et al., 2015; Taulaniemi et al. 2020), the physiotherapists who participated in this study were aware of the importance of goal-oriented strategies, motivational interviewing, promoting the understanding of the patients, their motivation to exercise, and their adherence to HP.

While increasing therapy time is partially limited by law, the use of the available time can be shifted towards attractive, patient-centered, meaningful, effective, and easy-to-perform HP. More time could be allocated to patient education on e.g., pain mechanisms and the subsequent importance of behavior change to promote self-efficacy. Room et al. (2021) found that patient non-adherence to recommended exercises is a challenging aspect of clinical practice. They identified a good patient-therapist relationship as the most important aspect of improving patient adherence. These findings are in line with the results of this study (Chapter 8 *Attachments*). There was a general interest in using digital tools, e.g., smartphone apps. However, facts about functionality, privacy, accessibility, and cost should limit the enthusiasm.

A finally conducted Delphi study with experts from research on adherence and clinical PT from six different countries aimed to evaluate an expert consensus on aspects influencing adherence of patients with LBP (Chapter 8 *Attachments*). Six domains were developed containing six to ten items (a total of 49 items) of which 17 were contributed by experts during round one. The highest consensus (> 90 %) was reached for the items: acceptance of therapy program, explanation of therapy programs, motivation of patients with LBP, expectation of patients with LBP, beliefs of patients with LBP, health literacy of patients with LBP (domain 1); trust of patients with LBP, taking patients with LBP seriously, including the views of patients with LBP, verbal communication, positively coined cues (verbal and non-verbal), understanding of morality by physiotherapists (domain 2); therapeutic agreements (domain 3); DBT must be individualized, manageability of DBT improves adherence (domain 5); good knowledge or courses, communication skills, individual patient-oriented PT strategy, authenticity of physiotherapists (domain 6).

A high level of consensus was reached for all items describing a positive patient-therapist relationship. This is in line with findings from qualitative studies reporting that the relationship between the healthcare provider and patient is of high importance to patients but also to physiotherapists (Alt et al., 2023b; Boutevillain et al., 2017; Martin et al., 2005; Room et al., 2021). The high level of consensus summarized the influence of the competencies of physiotherapists to influence the adherence of patients with LBP and interdisciplinary co-operation. Less information was available on aspects of DBT (Wälti et al., 2015; Zadro et al., 2019) and administrative burden (Herd et al., 2021) regarding their influence on adherence. There was an agreement that digital tools need to be individualized, easy to manage, and should provide graphics and trends to increase motivation.

According to all three research projects, it can be concluded that adherence of patients with LBP is relevant for long-term effective PT. The complexity of adherence has been illustrated by the results of this and other research projects on the quality of the patient-therapist relationship, biopsychosocial factors, and competencies of physiotherapists. In addition, it was found that digitization also influence adherence. In Germany and Switzerland, the treatment time and the legal regulations showed limitations for the facilitation of adherence in PT. Longitudinal studies are required for the development of multidimensional measurement tools and strategies to specifically facilitate adherence.

6. Ausführliche Zusammenfassung

Die drei nacheinander durchgeführten Studien lieferten ein tieferes Verständnis für die Komplexität der Adhärenz von PatientInnen mit LBP. Der Schwerpunkt lag dabei auf der Messung und der Förderung der Adhärenz, um eine langfristig effektive PT zu ermöglichen. Die zuerst vorgestellte systematische Übersichtsarbeit zeigte, dass die zur Messung der Adhärenz verwendeten Instrumente meist eindimensional und quantitativ waren, z. B. das Zählen der von PatientInnen durchgeführten Übungseinheiten (neun Studien) (Kapitel 8 *Attachements*). Multidimensionale Methoden zur Messung der Adhärenz, wie EARS oder SIRAS, wurden selten verwendet. Zu den anderen Ansätzen gehörten die Bewertungen der Patientenzufriedenheit, die einen spezifischen Aspekt des psychologischen Einflusses auf die Adhärenz bei PatientInnen mit LBP aufzeigten (Peek et al., 2019; van Tilburg et al., 2020). Es wurden jedoch auch einige mehrdimensionale Messmethoden angewandt. Der SIRAS war diesbezüglich in vier Studien das am häufigsten genutzte Instrument (Coppack et al., 2012; Hügli et al., 2015; Lonsdale et al., 2017; Mannion et al., 2009), gefolgt von den 4-5-Punkte-Likert-Adhärenzskalen in zwei Studien (Peek et al., 2019; van Tilburg et al., 2020) und dem multidimensionalen Adhärenzindex in einer Studie (Mannion et al., 2009). Der umfassendste Ansatz, der von sechs Studien gewählt wurde, war eine Kombination von Messoptionen (Coppack et al., 2012; Lonsdale et al., 2017; Mannion et al., 2009; Ris et al., 2021; Van Tilburg et al., 2020; Verbrugghe et al., 2018). Auf diese Weise wurden Informationen über ein Spektrum potenzieller psychosozialer Einflüsse auf die Adhärenz gesammelt.

Die wirksamste Strategie zur Förderung der Adhärenz konnte aufgrund der Vielzahl der Ansätze, einschließlich ihrer Dauer und Häufigkeit, der Art der Intervention und der nicht vergleichbaren Messinstrumente nicht ermittelt werden. Die auf psychologischen und kommunikativen Strategien basierende Ansätze wie COU (Alzahrani et al., 2021; Azevedo et al., 2021; Basler et al., 2007; Lenoir et al., 2020; Taulaniemi et al., 2020; Wälti et al., 2015), CBT (Göhner und Schlicht, 2006; Jay et al., 2015; Kerns et al., 2014), Festlegung von Zielen, Motivation und Veränderung negativer Überzeugungen durch Entwicklung einer Bewältigungsstrategie (Kolt und McEvoy, 2003; Jack et al., 2010; WHO, 2003; Collado-Mateo et al., 2021; Bachmann et al., 2018; Essery et al., 2017; Ritschl et al., 2020) waren die am häufigsten evaluierten Strategien. Nur Lonsdale et al. (2017) verwendeten spezi-

27

fische Kommunikationsstile und erzielten eine um 41 % höhere Adhärenz in der Gruppe mit COM.

Zur Erlangung eines besseren Verständnisses der Aspekte, die die Adhärenz von PatientInnen mit Rückenschmerzen multidimensional beeinflussen, wurde anschließend eine Fokusgruppenstudie durchgeführt (Kapitel 8 *Attachements*). In dieser Studie wurden Aspekte aus der Perspektive von PatientInnen und PhysiotherapeutInnen identifiziert, die die Adhärenz der PatientInnen beeinflussen. Die Hauptforderung der PatientInnen an die PhysiotherapeutInnen war ein individuell zielgerichtetes und kontrolliertes HP. Die PatientInnen wiesen deutlich darauf hin, dass aufgrund der Regelungen des Gesundheitssystems in der Schweiz und in Deutschland nicht genügend PT-Einheiten angeboten werden. In diesen Ländern werden die PT-Einheiten von den ÄrztInnen verschrieben, und jede Verordnung erlaubt maximal sechs (Deutschland) bis neun (Schweiz) Einheiten.

Entgegen unseren anfänglichen Erwartungen hing die Adhärenz weder von der Art der PT, z. B. aktive oder passive Methode, noch von der Dauer der Schmerzen ab. Im Allgemeinen schien die Adhärenz zu PT bei PatientInnen mit akuten Schmerzen höher zu sein. Die PhysiotherapeutInnen bestätigten einige der von den PatientInnen erwähnten Aspekte. Sie stimmten darin überein, dass Zeit ein einschränkender Faktor ist und dass zeitraubende Bürokratie ein Hindernis für evidenzbasierte Methoden wie die Aufklärung über Schmerzentstehung und individuelle HPs sein kann.

In früheren Veröffentlichungen wurden Faktoren aufgezeigt, die die Adhärenz aus Sicht der PhysiotherapeutInnen beeinflussen. Sie erwähnten die Kommunikationsfähigkeiten, das Wissen darüber, wie man Verhaltensänderungen fördert und die Motivation als relevante Aspekte (Babatunde et al., 2017; Lemmers et al., 2022; Maas et al., 2015, Peek et al., 2017). Ein neuer Aspekt war das Wecken „falscher" Erwartungen an die PT durch andere Gesundheitsfachleute, was die Aufklärung und die Verhaltensänderung der PatientInnen unnötig erschwert. Im Gegensatz zu den Ergebnissen anderer Studien (Coppack et al., 2012; Lemmers et al. 2022; Lonsdale et al., 2017; Maas et al., 2015; Taulaniemi et al. 2020) waren sich die PhysiotherapeutInnen, die an dieser Studie teilnahmen, der Bedeutung zielgerichteter Strategien, motivierender Gesprächsführung, der Förderung des Verständnisses der PatientInnen, ihrer Motivation zur Bewegung und der Notwendigkeit der Adhärenz von PatientInnen zu deren HPs bewusst.

Auch wenn die Erhöhung der Therapiezeit teilweise gesetzlich begrenzt ist, kann die verfügbare Zeit für die Entwicklung attraktiver, patientenzentrierter und wirksamer HPs genutzt werden. Es könnte mehr Zeit für die Patientenaufklärung, z. B. über Schmerzmeentstehung und die Relevanz von Verhaltensänderungen zur Förderung der Selbstwirksamkeit aufgewendet werden. Room et al. (2021) stellten fest, dass die Nichteinhaltung der empfohlenen Übungen durch die PatientInnen ein schwieriger Aspekt der klinischen Praxis ist. Sie bezeichneten eine gute Beziehung zwischen PatientIn und TherapeutIn als den wichtigsten Aspekt zur Verbesserung der Adhärenz von PatientInnen. Diese Erkenntnisse stimmen mit den Ergebnissen der vorliegenden Forschung überein (Kapitel 8 *Attachments*). Es bestand ein allgemeines Interesse an der Nutzung digitaler Hilfsmittel, z. B. Smartphone-Apps. Allerdings dürfte sich der Enthusiasmus aufgrund von Problemen mit der Funktionalität, dem Datenschutz, der Zugänglichkeit und den Kosten in Grenzen halten.

Eine abschließend durchgeführte Delphi-Studie mit ExpertInnen aus der Adhärenzforschung und der klinischen PT, die in sechs verschiedenen Ländern tätig waren, zielte darauf ab, einen Expertenkonsens zu den Aspekten zu ermitteln, die die Adhärenz von PatientInnen mit LBP beeinflussen (Kapitel 8 *Attachments*).

Es wurden sechs Sektionen mit sechs bis zehn Items (insgesamt 49 Items) entwickelt, von denen 17 von den ExpertInnen in der ersten Runde beigesteuert wurden. Der höchste Konsens (> 90 %) wurde bei den folgenden Items erreicht: Akzeptanz des Therapieprogramms, Erklärung des Therapieprogramms, Motivation der PatientInnen mit LBP, Erwartungen der PatientInnen mit LBP, Überzeugungen der PatientInnen mit LBP und Gesundheitskompetenz der PatientInnen mit LBP (Sektion 1); Vertrauen der PatientInnen mit LBP, Ernstnehmen der Beschwerden der PatientInnen mit LBP, Einbeziehen der Ansichten der PatientInnen mit LBP, verbale Kommunikation, positiv geprägte Hinweise (verbal und nonverbal) und Verständnis von Moral durch PhysiotherapeutInnen (Sektion 2); therapeutische Vereinbarungen (Sektion 3); DBT muss individualisiert sein und Handhabbarkeit der DBT verbessert die Adhärenz (Sektion 5); gute Kenntnisse oder Kurse, Kommunikationsfähigkeiten, individuelle patientenorientierte PT-Strategie und Authentizität der PhysiotherapeutInnen (Sektion 6).

Bei allen Items, die eine positive PatientInnen-TherapeutInnen-Beziehung beschreiben, wurde ein hohes Konsens-level erreicht. Dies steht im Einklang mit Ergebnissen aus qualita-

tiven Studien, die berichten, dass die Beziehung zwischen GesundheitsdienstleisterIn und PatientIn für PatientInnen, aber auch für PhysiotherapeutInnen von großer Bedeutung ist (Alt et al., 2023b; Boutevillain et al., 2017; Martin et al., 2005; Room et al., 2021). Diesbezüglich fasste das hohe Konsenslevel den Einfluss der Kompetenzen von PhysiotherapeutInnen auf die Adhärenz von PatientInnen mit LBP und die interdisziplinäre Zusammenarbeit zusammen.

Der Einfluss der Kommunikation auf die Adhärenz wurde auch in der RCT von Londsdale et al. (2017) untersucht. Sie fanden heraus, dass kommunikative Fähigkeiten von PhysiotherapeutInnen kurzfristig positive Auswirkungen auf die Adhärenz von PatientInnen (Wochen 1 - 12) hatten, aber nicht auf andere Adhärenzfaktoren, z.B. die Adhärenz zu Rückenübungen.

Zu den Aspekten der Digitalisierung (Wälti et al., 2015; Zadro et al., 2019) und des Verwaltungsaufwands (Herd et al., 2021) lagen weniger Informationen über deren Einfluss auf die Adhärenz vor. Es herrschte Einigkeit darüber, dass digitale Tools individualisiert und einfach zu handhaben sein müssen und Grafiken und Trends beinhalten sollten, um die Motivation zu steigern.

Alle drei Forschungsprojekte lassen den Schluss zu, dass die Adhärenz von PatientInnen mit LBP für eine langfristig effektive PT relevant ist. Die Komplexität der Adhärenz muss jedoch anhand der Definitionen von PatientInnen, PhysiotherapeutInnen und ExpertInnen näher erläutert werden. Die Komplexität der Adhärenz wurde durch die Ergebnisse dieses und anderer Forschungsprojekte verdeutlicht. Dazu zählen die Qualität der Beziehung zwischen PatientIn und TherapeutIn, die biopsychosozialen Faktoren und die Kompetenzen von PhysiotherapeutInnen. Darüber hinaus wurde festgestellt, dass auch die Digitalisierung und der Verwaltungsaufwand in der PT die Adhärenz beeinflussen. Diese beiden Aspekte wurden jedoch im Allgemeinen als weniger relevant eingestuft. In Deutschland und der Schweiz zeigten die Behandlungsdauer und die gesetzlichen Regelungen Einschränkungen für die Förderung der Adhärenz in der PT. Für die Entwicklung von mehrdimensionalen Messinstrumenten und Strategien zur gezielten Förderung der Adhärenz sind Langzeitstudien erforderlich. Der Schwerpunkt sollte auf der Adhärenz zu langfristig effektiven Strategien, wie dem Selbstmanagement von PatientInnen mit LBP liegen.

7. References

The following three publications with titles in bold are part of this cumulative dissertation:

Alt, A., Luomajoki, H., Lüdtke, K. (2023a). **Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy - A two-stage systematic review**. *Journal of Bodywork and Movement Therapies*. https://doi.org/10.1016/j.jbmt.2023.04.060

Alt, A., Luomajoki, H., & Luedtke, K. (2023b). **Which aspects facilitate the adherence of patients with low back pain to physiotherapy? A Delphi study.** *BMC musculoskeletal disorders*, 24(1), 615. https://doi.org/10.1186/s12891- 023-06724-z

Alt, A., Luomajoki, H., Roese, K., & Luedtke, K. (2023c). **How do non-specific back pain patients think about their adherence to physiotherapy, and what strategies do physiotherapists use to facilitate adherence? A focus group interview study.** *The Journal of manual & manipulative therapy*, 1–9. Advance online publication. https://doi.org/10.1080/10669817.2023.2258699

Álvarez-Rodríguez, J., Leirós-Rodríguez, R., Morera-Balaguer, J., Marqués-Sánchez, P., & Rodríguez-Nogueira, Ó. (2022). The Influence of the Locus of Control Construct on the Efficacy of Physiotherapy Treatments in Patients with Chronic Pain: A Systematic Review. *Journal of personalized medicine*, *12*(2), 232. https://doi.org/10. 3390/jpm12020232

Alzahrani, H., Mackey, M., Stamatakis, E., & Shirley, D. (2021). Wearables-based walking program in addition to usual physiotherapy care for the management of patients with low back pain at medium or high risk of chronicity: A pilot randomized controlled trial. *PloS one*, 16(8), e0256459. https://doi.org/10.1371/journal.pone.0256459

Areerak, K., Waongenngarm, P., & Janwantanakul, P. (2021). Factors associated with exercise adherence to pre-vent or treat neck and low back pain: A systematic review. *Musculoskeletal science & practice*, 52, 102333. https://doi.org/10.1016/j.msksp.2021.102333

Azevedo, D. C., Ferreira, P. H., de Oliveira Santos, H., Oliveira, D. R., Leite de Souza, J. V., & Pena Costa, L. O. (2021). Association between patient independence in performing an exercise program and adherence to home exercise program in people with chronic low back pain. *Musculoskeletal science & practice*, *51*, 102285. https://doi.org/10.1016/j.msksp.2020.102285

Babatunde, F. O., MacDermid, J. C., & MacIntyre, N. (2017). A therapist-focused knowledge translation intervention for improving patient adherence in musculoskeletal physiotherapy practice. *Archives of physiotherapy*, 7, 1. https://doi.org/10.1186/s40945-016-0029-x

Basler, H. D., Bertalanffy, H., Quint, S., Wilke, A., & Wolf, U. (2007). TTM-based counselling in physiotherapy does not contribute to an increase of adherence to activity recommendations in older adults with chronic low back pain--a randomised controlled trial. *European journal of pain (London, England)*, 11(1), 31–37. https://doi. org/ 10.1016/j.ejpain.2005.12.009

Bell, J. S., Airaksinen, M. S., Lyles, A., Chen, T. F., & Aslani, P. (2007). Concordance is not synonymous with compliance or adherence. *British journal of clinical pharmacology*, 64(5), 710–713. https://doi.org/10.1111/j. 1365-2125.2007.02971_1.x

Bollen, J. C., Dean, S. G., Siegert, R. J., Howe, T. E., & Goodwin, V. A. (2014). A systematic review of measures of self-reported adherence to unsupervised home-based rehabilitation exercise programmes, and their psychometric properties. *BMJ open*, *4*(6), e005044. https://doi.org/10.1136/bmjopen-2014-005044

Boutevillain, L., Dupeyron, A., Rouch, C. et al. (2017). Facilitators and barriers to physical activity in people with chronic low back pain: A qualitative study. *PloS one*, 12(7), e0179826. https://doi.org/10.1371/journal.pone. 0179826

Brincks, A. M., Feaster, D. J., Burns, M. J., & Mitrani, V. B. (2010). The influence of health locus of control on the patient-provider relationship. *Psychology, health & medicine*, 15(6), 720–728. https://doi.org/10.1080/1354 8506. 2010.498921

Chakrabarti S. (2014). What's in a name? Compliance, adherence and concordance in chronic psychiatric disorders. *World journal of psychiatry*, 4(2), 30–36. https://doi.org/10.5498/wjp.v4.i2.30

Cherkin, D., Balderson, B., Brewer, G. (2016). Evaluation of a risk-stratification strategy to improve primary care for low back pain: the MATCH cluster randomized trial protocol. *BMC musculoskeletal disorders*, 17(1), 361. https://doi.org/10.1186/s12891-016-1219-0

Collado-Mateo, D., Lavín-Pérez, A. M., Peñacoba, C., Del Coso, J., Leyton-Román, M., Luque-Casado, A., Gasque, P., Fernández-Del-Olmo, M. Á., & Amado-Alonso, D. (2021). Key Factors Associated with Adherence to Physical Exercise in Patients with Chronic Diseases and Older Adults: An Umbrella Review. *International journal of environmental research and public health*, 18(4), 2023. https://doi.org/10.3390/ijerph18042023

Coppack, R. J., Kristensen, J., & Karageorghis, C. I. (2012). Use of a goal setting intervention to increase adherence to low back pain rehabilitation: a randomized controlled trial. *Clinical rehabilitation*, 26(11), 1032–1042. https://doi.org/10.1177/0269215512436613

Epker, J., & Gatchel, R. J. (2000). Coping profile differences in the biopsychosocial functioning of patients with temporomandibular disorder. *Psychosomatic medicine*, 62(1), 69–75. https://doi.org/10.1097/00006842-20000 1000-00010

Essery, R., Geraghty, A. W., Kirby, S., & Yardley, L. (2017). Predictors of adherence to home-based physical therapies: a systematic review. *Disability and rehabilitation*, 39(6), 519–534. https://doi.org/10.3109/0963 8288. 2016. 1153160

German Medical Association (GMA). (2017). Nationale VersorgungsLeitlinie Nicht-spezifischer Kreuzschmerz – Kurzfassung, 2. Auflage. Version 1. https://doi.org/10.6101/AZQ/000377.

George, S. Z., Fritz, J. M., Silfies, S. P., Schneider, M. J., Beneciuk, J. M., Lentz, T. A., Gilliam, J. R., Hendren, S., & Norman, K. S. (2021). Interventions for the Management of Acute and Chronic Low Back Pain: Revision 2021. *The Journal of orthopaedic and sports physical therapy*, 51(11), CPG1–CPG60. https://doi.org/10.2519/jospt.2021. 0304

Göhner, W., & Schlicht, W. (2006). Preventing chronic back pain: evaluation of a theory-based cognitive-behavioural training programme for patients with subacute back pain. Patient education and counseling, 64(1-3), 87–95. https://doi.org/10.1016/j.pec.2005.11.018

Grabovac, I., & Dorner, T. E. (2019). Association between low back pain and various everyday performances: Activities of daily living, ability to work and sexual function. *Wiener klinische Wochenschrift*, 131(21-22), 541–549. https://doi.org/10.1007/s00508-019-01542-7

Gray, R., Wykes, T., & Gournay, K. (2002). From compliance to concordance: a review of the literature on interventions to enhance compliance with antipsychotic medication. *Journal of psychiatric and mental health nursing,* 9(3), 277–284. https://doi.org/10.1046/j.1365-2850.2002.00474.x

Hancox, J. E., van der Wardt, V., Pollock, K., Booth, V., Vedhara, K., & Harwood, R. H. (2019). Factors influencing adherence to home-based strength and balance exercises among older adults with mild cognitive

impairment and early dementia: Promoting Activity, Independence and Stability in Early Dementia (PrAISED). *PloS one*, 14(5), e0217387. https://doi.org/10.1371/journal.pone.0217387

Hardage, J., Peel, C., Morris, D., Graham, C., Brown, C., Foushee, H. R., & Braswell, J. (2007). Adherence to Exercise Scale for Older Patients (AESOP): a measure for predicting exercise adherence in older adults after discharge from home health physical therapy. *Journal of geriatric physical therapy (2001)*, *30*(2), 69–78. https://doi.org/10. 1519/00139143-200708000-00006

Hayden, J. A., Wilson, M. N., Riley, R. D., Iles, R., Pincus, T., & Ogilvie, R. (2019). Individual recovery expectations and prognosis of outcomes in non-specific low back pain: prognostic factor review. *The Cochrane database of systematic reviews*, 2019(11), CD011284. https://doi.org/10.1002/14651858. CD011284.pub2

Hügli, A. S., Ernst, M. J., Kool, J., Rast, F. M., Rausch-Osthoff, A. K., Mannig, A., Oetiker, S., & Bauer, C. M. (2015). Adherence to home exercises in non-specific low back pain. A 33 randomized controlled pilot trial. *Journal of bodywork and movement therapies*, 19(1), 177–185. https://doi.org/10.1016/j.jbmt.2014.11.017

Jack, K., McLean, S. M., Moffett, J. K., & Gardiner, E. (2010). Barriers to treatment adherence in physiotherapy outpatient clinics: a systematic review. *Manual therapy*, 15(3), 220–228. https://doi.org/10.1016/j.math. 2009. 12.004

Kerns, R. D., Burns, J. W., Shulman, M., Jensen, M. P., Nielson, et al. (2014). Can we improve cognitive-behavioral therapy for chronic back pain treatment engagement and adherence? A controlled trial of tailored versus standard therapy. *Health psychology: official journal of the Division of Health Psychology, American Psychological Association*, 33(9), 938–947. https://doi.org/10.1037/a0034406

Kolt, G. S., & McEvoy, J. F. (2003). Adherence to rehabilitation in patients with low back pain. *Manual therapy*, 8(2), 110–116. https://doi.org/10.1016/s1356-689x(02)00156-x

Kongsted, A., Ris, I., Kjaer, P., & Hartvigsen, J. (2021). Self-management at the core of back pain care: 10 key points for clinicians. *Brazilian journal of physical therapy*, 25(4), 396–406. https://doi.org/10.1016/j.bjpt. 2021. 05.002

Kortte, K. B., Falk, L. D., Castillo, R. C., Johnson-Greene, D., & Wegener, S. T. (2007). The Hopkins Rehabilitation Engagement Rating Scale: development and psychometric properties. *Archives of physical medicine and rehabilitation*, *88*(7), 877–884. https://doi.org/10.1016/j.apmr.2007.03.030

Lemmers, G., Bier, J. D., van Lankveld, W., Westert, G. P., Staal, J. B., & van der Wees, P. J. (2022). Guideline adherence of physiotherapists in the treatment of patients with low back pain: A qualitative study. *Journal of evaluation in clinical practice*, 10.1111/jep.13703. Advanced online publication. https://doi.org/10.1111/jep. 13703

Lenoir, D., Coppieters, I., Willaert, W., Kregel, J., Danneels, L. et al. (2019). Do sociodemographic features, pain sensitivity or pain catastrophizing relate to clinic-based adherence to physiotherapy in people suffering from chronic spinal pain? Secondary analysis of a randomized clinical trial. *Musculoskeletal science & practice*, 44, 102066. https://doi.org/10.1016/j.msksp.2019.102066

Lonsdale, C., Hall, A. M., Murray, A., Williams, G. C., McDonough, S. M. (2017). Communication Skills Training for Practitioners to Increase Patient Adherence to Home-Based Rehabilitation for Chronic Low Back Pain: Results of a Cluster Randomized Controlled Trial. *Archives of physical medicine and rehabilitation*, 98(9), 1732–1743.e7. https://doi.org/10.1016/j.apmr. 2017.02.025

Maas, M. J., van Dulmen, S. A., Sagasser, M. H., Heerkens, Y. F., van der Vleuten, C. P., Nijhuis-van der Sanden, M. W., & van der Wees, P. J. (2015). Critical features of peer assessment of clinical performance to enhance adherence to a low back pain guideline for physical therapists: a mixed methods design. *BMC medical education*, 15, 203. https://doi.org/10.1186/s12909-015-0484-1

Mallett, R., McLean, S., Holden, M. A., Potia, T., Gee, M., & Haywood, K. (2020). Use of the nominal group technique to identify UK stakeholder views of the measures and domains used in the assessment of therapeutic exercise adherence for patients with musculoskeletal disorders. *BMJ open*, 10(2), e031591. https://doi.org/ 10.1136/bmjopen-2019-031591

Mannion, A. F., Helbling, D., Pulkovski, N., & Sprott, H. (2009). Spinal segmental stabilisation exercises for chronic low back pain: programme adherence and its influence on clinical outcome. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*, 18(12), 1881–1891. https://doi.org/10.1007/s00586-009-1093-7

Martin, L. R., Williams, S. L., Haskard, K. B., & Dimatteo, M. R. (2005). The challenge of patient adherence. *Therapeutics and clinical risk management*, 1(3), 189–199.

Mayhew, E., Beresford, B., Laver-Fawcett, A., Aspinal, F., Mann, R. et al. (2019). The Hopkins Rehabilitation Engagement Rating Scale - Reablement Version (HRERS-RV): Development and psychometric properties. *Health & social care in the community*, 27(3), 777–787. https://doi.org/10.1111/ hsc.12696

McDonald, H. P., Garg, A. X., & Haynes, R. B. (2002). Interventions to enhance patient adherence to medication prescriptions: scientific review. *JAMA*, 288(22), 2868–2879. https://doi.org/10.1001/jama. 288.22. 2868

McLean, S., Holden, M. A., Potia, T., Gee, M., Mallett, R., Bhanbhro, S., Parsons, H., & Haywood, K. (2017). Quality and acceptability of measures of exercise adherence in musculoskeletal settings: a systematic review. *Rheumatology (Oxford, England)*, 56(3), 426–438. https://doi.org/10.1093/rheumatology/kew422

Newman-Beinart, N. A., Norton, S., Dowling, D., Gavriloff, D., Vari, C. et al. (2017). The development and initial psychometric evaluation of a measure assessing adherence to prescribed exercise: the Exercise Adherence Rating Scale (EARS). *Physiotherapy*, 103(2), 180–185. https://doi.org/10.1016/j.physio.2016. 11.001

Nicolson, P., Bennell, K. L., Dobson, F. L., Van Ginckel, A., Holden, M. A., & Hinman, R. S. (2017). Interventions to increase adherence to therapeutic exercise in older adults with low back pain and/or hip/knee osteoarthritis: a systematic review and meta-analysis. *British journal of sports medicine*, 51(10), 791–799. https://doi.org/10. 1136/bjsports-2016-096458

Nkhata, L. A., Brink, Y., Ernstzen, D., & Louw, Q. A. (2019). A systematic review on self-management education campaigns for back pain. *The South African journal of physiotherapy*, 75(1), 1314. https://doi.org/10.4102/ sajp.v75i1.1314

Oliveira, C. B., Maher, C. G., Pinto, R. Z., Traeger, A. C., Lin, C. C., Chenot, J. F., van Tulder, M., & Koes, B. W. (2018). Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. *European spine journal : official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society*, 27(11), 2791–2803. https://doi.org/10.1007/s00586-018-5673-2

Palazzo, C., Klinger, E., Dorner, V. et al. (2016). Barriers to home-based exercise program adherence with chronic low back pain: Patient expectations regarding new technologies. *Annals of physical and rehabilitation medicine*, 59(2), 107–113. https://doi.org/10.1016/j.rehab.2016.01.009

Peek, K., Carey, M., Sanson-Fisher, R., & Mackenzie, L. (2017). Physiotherapists' perceptions of patient adherence to prescribed self-management strategies: a cross-sectional survey of Australian physiotherapists. *Disability and rehabilitation*, 39(19), 1932–1938. https://doi.org/10.1080/09638288.2016.1212281

Ritschl, V., Stamm, T. A., Aletaha, D. et al. (2020). Prevention, screening, assessing and managing of non-adherent behaviour in people with rheumatic and musculoskeletal diseases: systematic reviews informing

the 2020 EULAR points to consider. *RMD open*, 6(3), e001432. https://doi.org/10.1136/rmdopen-2020-001432

Room, J., Boulton, M., Dawes, H., Archer, K., & Barker, K. (2021). Physiotherapists' perceptions of how patient adherence and non-adherence to recommended exercise for musculoskeletal conditions affects their practice: a qualitative study. *Physiotherapy*, 113, 107–115. https://doi.org/10.1016/j.physio.2021.06.001

Sarbacker, G. B., & Urteaga, E. M. (2016). Adherence to Insulin Therapy. Diabetes spectrum : *a publication of the American Diabetes Association*, 29(3), 166–170. https://doi.org/10.2337/diaspect.29.3.166

Sengul, Y., Kara, B., & Arda, M. N. (2010). The relationship between health locus of control and quality of life in patients with chronic low back pain. *Turkish neurosurgery*, 20(2), 180–185. https://doi.org/10.5137/1019-5149. JTN.2616-09.1

Shin, J. T., Park, R., Song, W. I., Kim, S. H., & Kwon, S. M. (2010). The redevelopment and validation of the Rehabilitation Adherence Questionnaire for injured athletes. *International journal of rehabilitation research. Internationale Zeitschrift fur Rehabilitationsforschung. Revue internationale de recherches de readapttation*, *33*(1), 64–71. https://doi.org/10.1097/MRR.0b013e32832fea39

Taulaniemi, A., Kankaanpää, M., Rinne, M., Tokola, K., Parkkari, J., & Suni, J. H. (2020). Fear-avoidance beliefs are associated with exercise adherence: secondary analysis of a randomised controlled trial (RCT) among female healthcare workers with recurrent low back pain. *BMC sports science, medicine & rehabilitation*, 12, 28. https://doi.org/10.1186/s13102-020-00177-w

Van Dillen, L. R., Norton, B. J., Sahrmann, S. A., Evanoff, B. A., Harris-Hayes, M. et al. (2016). Efficacy of classification-specific treatment and adherence on outcomes in people with chronic low back pain. A one-year follow-up, prospective, randomized, controlled clinical trial. *Manual therapy*, 24, 52–64. https://doi.org/10. 1016/ j.math.2016.04.003

Van Tilburg, M., Kloek, C., Staal, J. B., Bossen, D., & Veenhof, C. (2022). Feasibility of a stratified blended physiotherapy intervention for patients with non-specific low back pain: a mixed methods study. *Physiotherapy theory and practice*, 38(2), 286–298. https://doi.org/10.1080/09593985.2020.1756015

Verbrugghe, J., Agten, A., O Eijnde, B., Olivieri, E., Huybrechts, X., Seelen, H. et al. (2018). Feasibility of high intensity training in nonspecific chronic low back pain: A clinical trial. Journal of back and musculoskeletal rehabilitation, 31(4), 657–666. https://doi.org/10.3233/BMR-170810

Wälti, P., Kool, J., & Luomajoki, H. (2015). Short-term effect on pain and function of neurophysiological education and sensorimotor retraining compared to usual physiotherapy in patients with chronic or recurrent non-specific low back pain, a pilot randomized controlled trial. *BMC musculoskeletal disorders*, 16, 83. https://doi.org/10. 1186/s12891-015-0533-2

WHO. World Health Organisation. (2003). Adherence to Long Term Therapies – Evidence for Action. *WHO Library Cataloguing-in-Publication Data*.

Zadro, J. R., Shirley, D., Simic, M., Mousavi, S. J., Ceprnja, D., Maka, K., Sung, J., & Ferreira, P. (2019). Video-Game-Based Exercises for Older People with Chronic Low Back Pain: A Randomized Controlledtable Trial (GAME-BACK). *Physical therapy*, *99*(1), 14–27. https://doi.org/10.1093/ptj/pzy112

8. Attachments (original publications)

Study 1 (original publication of the two-stage systematic review)
Study 2 (original publication of the focus group study)
Study 3 (original publication of the Delphi study)
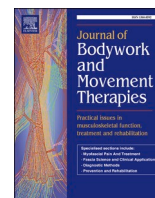
Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy - A two-stage systematic review

A. Alt [a,*], H. Luomajoki [b], K. Lüdtke [a]

[a] Universität zu Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, Germany
[b] Zürich University of Applied Sciences, Institute of Physiotherapy, Katharina Sulzer Platz 95, 8401, Winterthur, Switzerland

ARTICLE INFO

Handling Editor: Dr Jerrilyn Cambron

ABSTRACT

Background: Sustainable management for non-specific low back pain relies on adherence. This requires effective strategies to facilitate but also tools to measure adherence to physiotherapy.
Objective: This two-stage systematic review aims to identify (1) tools to measure non-specific back pain patients' adherence to physiotherapy and (2) the most effective strategy to facilitate patients' adherence to physiotherapy.
Method: PubMed, Cochrane, PEDro, and Web of Science were searched for English language studies measuring adherence in adults with low back pain. Following PRISMA recommendations, scoping review methods were used to identify measurement tools (stage 1). The effectiveness of interventions (stage 2), followed a predefined systematic search strategy. Two independent reviewers selected eligible studies (software Rayyan), analyzed these for risk of bias using the Downs and Black checklist. Data relevant to assess adherence were collected in a predesigned data extraction table. Results were heterogeneous and hence summarized narratively.
Results: Twenty-one studies were included for stage 1 and 16 for stage 2. Identified were 6 different tools to measure adherence. The most used tool was an exercise diary; the most common more multidimensional tool was the Sports Injury Rehabilitation Adherence Scale. Most included studies were not designed to improve or measure adherence but used adherence as a secondary outcome for new exercise programs. The most promising strategies for facilitating adherence were based on cognitive behavioral principles.
Conclusion: Future studies should focus on the development of multidimensional strategies to facilitate adherence to physiotherapy and appropriate tools to measure all aspects of adherence.

1. Background

Managing low back pain is a multidimensional treatment process addressing cognition, function, and pain to reach long-lasting effects and reduce the risk of chronification (George et al., 2021; Grabovac and Dorner, 2019; Hayden et al., 2019). Sustainable pain management requires self-management (Grabovac and Dorner, 2019; Nkhata et al., 2019) and self-management relies on the patients' level of adherence (Kongsted et al., 2021).

Adherence has been defined as: "the extent to which a person's behavior conforms to the agreed-upon recommendations of a health care provider" (WHO. World Health Organisation, 2003). In physiotherapy (PT), the concept of adherence is multidimensional (Jack et al., 2010; Kolt and McEvoy 2003). It combines the following of advice, attending appointments, and (the frequency of) performing prescribed exercises (correctly) (Jack et al., 2010).

In medicine, adherence is defined as the patient's willingness to follow the treatment recommendations agreed with the physician to the best of their knowledge and beliefs. The term emphasizes the concordant behavior of patient and physician (Chakrabarti 2014; McDonald et al., 2002) and thereby exceeds compliance, usually defined as "doing what the doctor said" (Gray et al., 2002). For self-management in musculoskeletal (MSK) disorders, such as non-specific low back pain (NSLBP), where adherence to exercises is particularly important for symptom rehabilitation, several factors have been reported that keep patients engaged. These include confidence in the recommended exercises, individualization, scope of a program (design, ease of use), social support, self-efficacy, and smooth integration of exercises into daily life (Collado-Mateo et al., 2021; Jack et al., 2010; Kolt and McEvoy 2003). Sufficient consideration of patients' preferences and backgrounds, as well as accessibility and flexibility of treatment programs, support adherent behavior approaches (Bachmann et al., 2018, Collado-Mateo

---

* Corresponding author. Universität zu Lübeck, Institute of Health Sciences, Department of Physiotherapy, Ratzeburger Allee 160, 23562, Lübeck, Germany.
  E-mail address: andreas.alt@student.uni-luebeck.de (A. Alt).

et al., 2021; Essery et al., 2017; Ritschl et al., 2020). Especially in older and geriatric patients, "cognition" is a relevant property for adherence quality (Di Lorito 2020). Accordingly, a strong common denominator for improving adherence could be "shared-decision making" (McDonald et al., 2002), which again requires targeted communication (Babatunde et al., 2017; Roodbeen et al., 2020).

However, the level of patients' adherence does not depend exclusively on factors that can be directly influenced, such as the practicability of exercises or the comprehensibility of explanations regarding their necessity, but also on personal factors, such as the level of education (Areerak et al., 2021).

Barriers to adherence include difficulties in contacting care providers, a lack of motivation and supportive environment, lack of self-discipline or time, forgotten exercises, difficult or non-effective exercises, patients' beliefs, the therapist-patient relationship, patient involvement, patient attitudes, cultural aspects, and language (Boutevillain et al., 2017; Cherkin et al., 2016; Lonsdale et al., 2017; Maas et al., 2015; Martin et al., 2005, Palazzo et al., 2016).

After explaining the complexity of adherence due to its many components, multidimensional nature, and plethora of influencing factors, it becomes clear that any intervention to improve adherence seems to require a complex strategy. Furthermore, measurement tools to assess adherence should capture the multilayered contributing factors to adherence to ensure adequate analysis (McLean et al., 2017). This has led to a shift from simply counting the frequency of performed exercise sessions to more complex measurement tools, capturing e.g. patients' motivation, trust in their therapists, such as the Exercise Adherence Rehabilitation Scale (EARS) (Mallett et al., 2020; McLean et al., 2017). However, to date, no specific tool is recommended for the assessment of NSLBP patients' adherence to PT.

Equally, no recommendation is currently available for a strategy to be used by physiotherapists to enhance NSLBP patients' adherence. Since it is unclear, which influencing factors should be addressed (e.g. motivation or therapist-patient-relationship or app based delivery of exercises) this review encompasses all strategies reported in NSLBP populations to provide an overview of potentially effective approaches. The aims of this two-stage systematic review are to identify (1) tools used to measure NSLBP patients' adherence to PT and (2) the most effective strategy to facilitate NSLBP patients' adherence to PT.

2. Method

This review follows the recommendations from the Cochrane handbook for systematic reviews to answer the question on the strategies and their effectiveness to facilitate adherence and is reported based on the guidelines by PRISMA for scoping reviews (question 1) and systematic reviews (question 2) (Cumpstonet al. 2019, Tricco et al., 2018). The pre-registered protocol for the review is available at Open Science Framework: https://osf.io/9pjhb. Since most studies that were designed to evaluate a strategy to facilitate adherence also measured its effect, the literature search was combined for both questions.

2.1. Eligibility criteria

Inclusion criteria were randomized controlled trials (RCT), controlled trials (CT) or observational studies, and cohort studies reporting on adult patients suffering from NSLBP, currently receiving PT treatment. All studies published from inception until 31st of January 2022 were eligible (Table 1).

2.2. Information sources

PubMed, Cochrane, PEDro, and Web of Science databases were used for the systematic searches. Hand searching in literature lists of included articles was added to receive further relevant results after the systematic searches. Additional searches were conducted on the websites of the journals in which articles included during the systematic search were published (Musculoskeletal Science and Practice, British Medical

Table 1
Eligibility criteria for study inclusion and search strategy.

Eligibility criteria		
	Inclusion criteria	**Exclusion criteria**
P	Non-specific low back pain, adult	Red flags; Post surgery; Sciatica; Scoliosis; acute disc disease; children
I	Tool, strategy, intervention to enhance adherence	Not currently receiving physiotherapy
O	**AND / OR** Measurement tool for adherence	
Study types	RCTs, CTs, explorative studies, observational studies	Case studies and case series with <10 participations
Setting	Currently receiving physiotherapy treatment	Narrative reviews
Search strategy		
Orientation	**Search terms**	
P	"Back pain" OR "low back pain" AND "non-specific" OR "nonspecific"	
I	"Adherence" OR "compliance" OR "communication" OR "motivation" OR "reminder" OR "patient therapist relationship" OR "exercise usability" OR "goal setting" OR "shared decision making" OR "education" OR "motivational interviewing" OR "exercise programs" OR app OR app-based intervention	
O	"adherence" OR "EARS" OR "Exercise adherence rating scale" OR "CHAMPS" OR "Physical Activity Questionnaire for Older Adults" OR "SIRAS" OR "Sports Injury Rehabilitation Adherence Scale" OR "RAQ" OR "Rehabilitation Adherence Questionnaire" OR "AESOP" OR "adherence to exercise scale for older patients" OR "HRERS" OR "Hopkins rehabilitation engagement rating scale" OR PRPS OR "Pittsburgh rehabilitation participation scale" OR "exercise diary" OR "exercise frequency"	
Setting	"Physiotherapy" OR "physical therapy"	
CT = clinical trial, < smaller than, I = interventions, O = outcomes, P = patients, RCT = randomized controlled trial		

Journal, and Archives of Physical Medicine and Rehabilitation). Only results in English language were included.

2.3. Search strategy

The search strategy is based on the patient-intervention-outcome (PIO) method and includes all for this review relevant variables (Table 1).

2.4. Selection process

The final date of the search was the 31st of January 2022. Studies had to either report a strategy to facilitate patient adherence or a primary or secondary outcome measure for patient adherence. The software Rayyan was used by the two reviewers to independently screen publications against the eligibility criteria at title/abstract level (Ouzzani et al., 2016). All publications rated as "include" for either stage 1 or stage 2 by at least one reviewer were retrieved as full texts and screened against the same eligibility criteria. In cases of disagreement, these were solved in a subsequent consensus discussion. A third reviewer was available as a "judge" in cases where no consensus was reached.

2.5. Data extraction

Data of included full-text publications were extracted in pre-specified data extraction tables for stage 1 and stage 2. These included information on author, year, study population, outcomes measured, and for stage 2 also on the strategy used to facilitate treatment adherence, the control intervention, and the effects achieved. Effects were shown as differences between the intervention and control group, presented as percentage change.

2.6. Data synthesis

In a narrative synthesis of the data, the strategies used to facilitate treatment adherence and tools to measure its outcome were summarized by type of strategy or tool. To determine the effectiveness of strategies to facilitate NSLBP patients' adherence to PT, it was planned that if more than one study on a specific strategy to enhance adherence was identified with homogeneous outcome measures, meta-analyses will be conducted using random effect models.

2.7. Risk of bias analysis in studies

For studies evaluating the effectiveness of strategies to facilitate adherence, we used the Downs and Black checklist to analyze the risk of bias. This tool is a valid and reliable checklist to analyze the risks of bias of randomized and non-randomized studies (Downs and Black, 1998). The checklist includes the following features: appropriate for assessing both randomized and non-randomized cohort studies; providing an overall score for study quality and a profile of scores not only for the quality of reporting, internal validity (bias and confounding), and power, but also for external validity. This checklist contents 27 items. In the original version of this checklist, the 27th question has 6 possible answers. We reduced this to 3 options. Downs and Black score ranges were interpreted as excellent (26–28); good (20–25); fair (15–19); and poor (14) (Downs and Black 1998). For the calculation of interrater agreement before the consensus meeting, Cohen's Kappa for 2 raters and 3 categories were calculated, using the online software "GraphPad".

3. Results

A total of 293 single studies were initially identified from all databases and 214 articles were selected for a title and abstract screen. 119 eligible articles from all databases were retrieved for a full-text assessment. In total, we identified 24 single studies that were initially relevant

for stage 1 and/or stage 2. But 2 had no specific correlation to the research questions and 1 had simulated subjects and could not be used for further analyses. 21 studies were finally relevant for stage 1 and 16 for stage 2. Furthermore, 16 studies reported on the effectiveness of strategies to facilitate adherence of NSLBP patients (Fig. 1).

3.1. Results of risk of bias analysis

The RoB analysis conducted on the 16 studies included for stage 2 resulted in an average rating of "good" (20–25 points) according to the Black and Downs checklist. The ratings for each study after consensus are detailed in Table 2. The interrater agreement prior to consensus was Cohen's Kappa 0.88 (95% confidence interval from 0.352 to 1).

3.2. Study characteristics

In total, 3.504 subjects were included across studies selected to answer the question on tools to measure adherence. 3.249 patients were studied for stage 2. These high numbers are due to one large observational study by Ris et al. (2021) (n = 1.730). Several measurement methods were identified to measure adherence. These ranged from exercise diaries counting the number of sessions performed, to more comprehensive, multidimensional questionnaires, such as the SIRAS (Table 3).

Various strategies for facilitating adherence were also noted, corresponding to the stage 2 question. These ranged from strategies based on cognitive behavioral therapy (CBT) principles to counseling strategies (COU) or digital intervention tools (DIT). In addition, indications of correlations between the intensity of pain or disability and the level of adherence were recorded (Table 3).

3.3. Results of individual studies

Stage 1 of the review identified the SIRAS as the most used multidimensional questionnaire to measure adherence in NSLBP populations
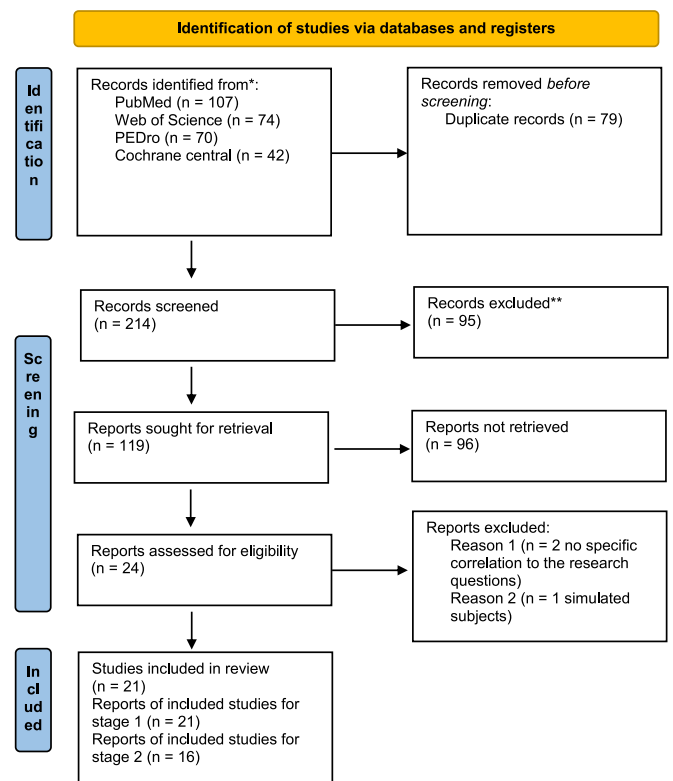

Fig. 1. Flow chart of study identification (Page et al., 2021).

Table 2
Risk of bias analysis by Downs and Black checklist.

Risk of bias analysis by Downs and Black checklist

Questions of Downs and Black checklist as numbers

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Total	Kappa	CI (= 95%)
Alzahrani et al., (2021) (n 26)	1	1	1	1	2	1	1	0	1	1	1	0	1	0	1	0	1	1	1	1	1	1	1	0/1	1	1	0	23	0.892	0.686 to 1
Azevedo et al., (2021) (n 148)	1	1	1	1	2	1	1	0	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	0	1	0	1	19	1	1 to 1
Basler et al., (2007) (n 170)	1	1	1	1	2	1	1	0	0	0	1	0	0/1	1	0/1	0	1	1	1	1	1	1	1	1	1	1	1	24	0.769	0.467 to 1
Coppack et al., (2012) (n 48)	1	1	1	1	2	1	1	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1/0	20	0.922	0.775 to 1
Göhner and Schlicht (2006) (47)	1	1	1	1	2	1	1	0	0	0	1	0	1	0	0/1	0	1	1	1	1	1	1	0	1	1	0	0	20	0.922	0.773 to 1
Hügli et al., (2015) (n 20)	1	1	1	1	2	1	1	0/1	0	1	1	0	1	0	0	0	1	1	1	1	1	1	1	1	1	0	0	21	0.915	0.751 to 1
Kerns et al., (2014) (128)	1	1	1	1	2	1	1	0/1	0	0	1	0	1	1	1	0	1	1	1	1	1	1	1	0/1	1	1	1	23	0.719	0.352 to 1
Lenoir et al., (2019) (n 120)	1	1	1	1	2	1	1	0/1	1	1	1	0/1	1	0	1	0	1	1	1	1	1	1	1	0	1/0	1	1	23	0.766	0.459 to 1
Lonsdale et al., (2017) (n 255)	1	1	1	1	2	1	1	0	0	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	0	1	22	1	1 to 1
Mannion et al., (2009) (n 37)	1	1	1	1	0	1	1	0	1	1	1	0	1	0	1	0	0/1	1	1	1	0/1	0	0	0	1	1	1	17	0.843	0.630 to 1
Jay et al., (2015) (n 112)	1	1	1	1	2	1	1	0	1	1	0	0	1	0/1	1	0	1	1	1	1	1	1	1	1	0	1	1	23	0.890	0.679 to 1
Ris et al., (2021) (n 1.730)	1	1	1	1	2	1	1	0	1	1	1	0	1	0	0	0	1	1	1	1	1	1	0	0	0/1	1	1	20	0.918	0.753 to 1
Taulaniemi et al., (2020) (n 219)	1	1	1	1	2	1	1	0	1	1	0	0	1	0	0	0	1	1	1	1	1	1	1	0	1	1	1	21	1	1 to 1
Van Dillen et al., (2016) (n 101)	1	1	1	1	2	1	1	0	0	1/0	1	0	0/1	0/1	0	0	1	1	1	1	1	1	1	1	1	1	1	23	0.760	0.450 to 1
Wälti et al., (2015) (n 28)	1	1	1	1	2	1	1	0	1	1	0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	0	23	1	1 to 1
Zadro et al., (2019) (n 60)	1	1	1	1	2	1	1	0	0	1	0	0	1	0	1	0/1	1	1	1	1	1	1	1	1	1/0	1	1	23	0.768	0.462 to 1

The Downs and Black checklists contents 27 items which are represented in single numbers. For all items only one number is given, which corresponds to the rating of both researchers.

Rating: Unable to determine = 0, No = 0, Yes = 1.

Items:

1. Is the hypothesis/aim/objective of the study clearly described?.
2. Are the main outcomes to be measured clearly described in the Introduction or Methods section?.
3. Are the characteristics of the patients included in the study clearly described?.
4. Are the interventions of interest clearly described?.
5. Are the distributions of principal confounders in each group of subjects to be compared clearly described?.
6. Are the main findings of the study clearly described?.
7. Does the study provide estimates of the random variability in the data for the main outcomes?.
8. Have all important adverse events that may be a consequence of the intervention been reported?.
9. Have the characteristics of patients lost to follow-up been described?.
10. Have actual probability values been reported (e.g., 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?.
11. Were the subjects asked to participate in the study representative of the entire population from which they were recruited?.
12. Were those subjects who were prepared to participate representative of the entire population from which they were recruited?.
13. Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?.
14. Was an attempt made to blind study subjects to the intervention they have received?.
15. Was an attempt made to blind those measuring the main outcomes of the intervention?.

16. If any of the results of the study were based on "data dredging", was this made clear?.
17. In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?.
18. Were the statistical tests used to assess the main outcomes appropriate?.
19. Was compliance with the intervention/s reliable?.
20. Were the main outcome measures used accurate?.
21. Were the patients in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?.
22. Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over. The same period of time?.
23. Were study subjects randomized to intervention groups?.
24. Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?.
25. Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?.
26. Were losses of patients to follow-up taken into account?.
27. Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%.

(Coppack et al., 2012; Hügli et al., 2015; Lonsdale et al., 2017; Mannion et al., 2009) (Table 3). Even more frequently used were exercise or therapy diaries or protocols to document the number of practiced sessions (Azevedo et al., 2021; Basler et al., 2007; Hügli et al., 2015; Mannion et al., 2009; Sharma et al., 2019; Taulaniemi et al., 2020; van Dillen et al., 2016; Verbrugghe et al., 2018; Zadro et al., 2019) (Table 3).

Digital counting, as a common feature of exercise smartphone applications, was also used frequently to report the number of participated exercise or therapy sessions (Alzahrani et al., 2021; Kerns et al., 2014; Lenoir et al., 2019; Wälti et al., 2015) (Table 3).

Reports or interviews, such as questions to evaluate patients' adherence to exercises or PT programs were used by Jay et al. (2015), Macedo et al. (2021), Peek et al. (2019), Ris et al. (2021) and Saner et al. (2018) (Table 3). In addition, some studies used a combination of tools (Coppack et al., 2012; Lonsdale et al., 2017; Mannion et al., 2009; Ris et al., 2021; van Tilburg et al., 2020; Verbrugghe et al., 2018). These tools were primarily directed to quantify motivation, satisfaction, behavioral regulation, quality of life, and fear of movement as the specific criteria which the authors correlated with patients' adherence to PT sessions.

16 single studies, in which adherence could be influenced by strategies and measured were detected. The studies conducted by Mannion et al. (2009) and Ris et al. (2021) included only one cohort and no comparison. Most frequently (6 studies) evaluated were strategies that can be summarized as COU (Alzahrani et al., 2021; Azevedo et al., 2021; Basler et al., 2007; Lenoir et al., 2019; Taulaniemi et al., 2020; Wälti et al., 2015) and 3 as CBT (Göhner and Schlicht 2006; Jay et al., 2015; Kerns et al., 2014), both effectively facilitating NSLBP patients' adherence to PT. Introducing specific communication styles was another strategy used successfully to enhance adherence Lonsdale et al. (2017). This might include goal setting, as used by Coppack et al. (2012) who showed significantly higher scores in the SIRAS post-intervention. The studies by Wälti et al., (2015), Hügli et al., 2015, Basler et al., (2007) and Taulaniemi et al. (2020) showed no significant differences in influences on adherence between groups assigned different strategies. In 3 studies DIT were used in their respective groups, also facilitating adherence. These include the RCTs by Hügli et al. (2015), Wälti et al. (2015), and Zadro et al. (2019) (Table 4). However, there were also some negative results in the studies by Alzahrani et al. (2021), Taulaniemi et al. (2020), Mannion et al. (2009), and Jay et al. (2015) who recorded lower adherence levels with more severe disability or pain (Table 4).

4. Discussion

This two-stage systematic review provides a comprehensive overview of strategies used to facilitate adherence to PT in patients with NSLBP and tools to measure NSLBP patients' adherence to PT.

The most frequently used tools to measure adherence in were simple counting methods, such as diaries and protocols documenting the number of PT sessions performed in 9 of the included studies. Other approaches included assessments of patient satisfaction (Peek et al., 2019, van Tilburg et al., 2020), recognizing a very specific aspect of psychological influence on adherence in NSLBP patients. However, some more multidimensional measurement methods were also applied: The SIRAS was the most common tool in 4 studies (Coppack et al., 2012; Hügli et al., 2015; Lonsdale et al., 2017; Mannion et al., 2009), followed by 4-5-point Likert adherence scales in 2 studies (Peek et al., 2019, van Tilburg et al., 2020) and the multidimensional adherence index in 1 study (Mannion et al., 2009).

The most comprehensive approach, as chosen by 6 studies (Coppack et al., 2012; Lonsdale et al., 2017; Mannion et al., 2009; Ris et al., 2021; van Tilburg et al., 2020; Verbrugghe et al., 2018), was a combination of measurement options, thereby collecting information on a spectrum of potential psychosocial influences on adherence. In 15 of 21 studies, adherence was measured more than once and included post-intervention follow-up time points to assess the sustainability of interventions.

Table 3
Characteristics of included studies to stage 1.

Authors	Study design	Study objective	Measurement tools	Participations per group	Follow-up time (w)	Participant characteristics
Alzahrani et al., (2021)	RCT	Examination of feasibility and initial efficacy of a wearables-based walking intervention in addition to usual PT care	Recording the frequency of the used walking program	G1: n = 12 G2: n = 14	26 w	Heterogenic, mean age: 43.6 years, risk classification of chronicity > medium NSLBP
Azevedo et al., (2021)	RCT	Assessment of possible association between patient independence in performing 2 different HE programs	Exercise diary	G1: n = 67 G2: n = 70	X	Heterogenic, mean: 41.3 years, duration of CNSLBP: >3 month CNSLBP
Basler et al., (2007)	RCT	Examining the outcome of COU in PT based on the TTM in a sample	Exercise diary	G1: n = 86 G2: n = 84	X	Heterogenic, mean: 70 years, duration of CNSLBP: no data CNSLBP
Coppack et al., (2012)	RCT	Examine the effects of a GS intervention on SE, adherence and treatment outcome	SIRAS	G1: 16 G2: 16 G3: 16	Day 6 and 11	Heterogenic, 33 years (mean), all engaged in low intensity exercise prior to admission NSLBP
Hügli et al., 2015	RCT	Exploration of the differences in HE adherence between patients who perform conventional exercises and those who exercise with AF	Exercise diary and SIRAS	G1: n = 10 G2: n = 10	X	Heterogenic, mean: 35.9 years, duration of NSLBP: >4 weeks NSLBP
Jay et al., (2015)	RCT	Investigation the effect of a multifaceted worksite intervention on pain and stress among laboratory technicians	Reports or interviews	G1: n = 56 G2: n = 56	10 w after baseline	Heterogenic, mean age: 46.5 years, duration of NSLBP: 3.4/10, Smokers: 10% CMSK
Kerns et al., (2014)	RCT	Evaluation whether TCBT that incorporated preferences for learning specific cognitive and/or behavioral skills	Recordings of participated sessions	G1: n = 68 G2: n = 60	15 weeks after last baseline assessment	Heterogenic, mean age: 55 years, duration of CNSLBP: >6 month CNSLBP
Lenoir et al., (2019)	RCT	Examining whether socio-demographic variables, pain or functionality are related to the degree of clinic-based therapy adherence	Treatment session diary (protocol)	G1: n = 60 G2: n = 60	Immediately at the end of the treatment	Heterogenic, mean age: 40.6, duration of CNSLBP: >3 month CNSLBP
Lonsdale et al., (2017)	RCT	Assessment of an intervention designed to enhance physiotherapists' COM skills on patients' adherence to recommendations regarding home-based rehabilitation	SIRAS	G1: n = 124 G2: n = 131	1, 4, 12, 24 w	Heterogenic, mean age: 45.4, duration of CNSLBP: >3 month CNSLBP
Macedo et al., (2021)	RCT	Testing the feasibility of the Back to Living Well program for patients with NS LBP in terms of recruitment, barriers and facilitators for the engagement in the program, adherence to the program, satisfaction with the exercise and education sessions and data collection procedures	Open questions about barriers related to adherence with the EP	1 G: n = 17	12, 24 w	Heterogenic, mean age: 54.9, duration of pain: currently pain free or mild no data
Mannion et al., (2009)	PS	Examining factors associated with adherence and the relationship between adherence and outcome after a programe of stabilization exercises.	MAI, SIRAS, Exercise diary	n = 37	X	Heterogenic, mean age: 44 years, duration of CNSLBP >3 month CNSLBP
Peek et al., (2019)	OS	Comparison of patient-reported levels of adherence with PTs' perceptions of patient adherence; and exploration of patients' proportion who could accurately recall and demonstrate the exercises contained within their prescribed EP for CNSLBP	4-point Likert adherence scale	1 G: n = 61	Individual timed follow-up	Heterogenic, mean age: 58 years, duration of CNSLBP: >12 w
Ris et al., (2021)	OS	Evaluation of participants' adherence to the intervention and identified characteristics related to the completion of GLA:D® Back. Specifically: 1) Investigation of participations' adherence level enrolled in the program 2) participant-related factors associated with low attendance	self-reported attendance to education and exercise sessions	G1: n = 392 G2: n = 420 G3: n = 918 G4: n = 665	12 w	Heterogenic, mean age: 59.5 years, duration of CNSLBP: most >12 month (59%)
Saner et al., (2018)	QS	Exploration of the patients' perspectives on long term adherence to such exercise programs.	Open end questions about perceptions to adherence	G1: n = 52 G2: n = 54	X	Heterogenic, mean age: 44 years, duration of pain: 9.5 years
Sharma et al., (2019)	RCT	1) Develop pain education materials in Nepali and 2) determine the feasibility of conducting a RCT of a pain education intervention using these materials in Nepal	Exercise diary (treatment frequency)	G1: n = 20 G2: n = 20	1 w to 10 days	Heterogenic, mean age: >18 years, duration of NSLBP: no specific limits

Table 3 (*continued*)

Authors	Study design	Study objective	Measurement tools	Participations per group	Follow-up time (w)	Participant characteristics
Taulaniemi et al., (2020)	RCT	Examination of which BPS factors contributed to exercise adherence during a 6-month neuromuscular exercise intervention, and to investigate how exercising affects FABs	Exercise diary	G1: n = 58 G2: n = 52	24, 48 w	Female, mean age: 46 years, health care workers, duration of pain: NSLBP
Van Dillen et al., (2016)	RCT	Comparison of the efficacy of a CST and a NCT treatment and examine the moderating effect of adherence on outcomes	Exercise diary (self-recording)	G1: n = 47 G2: n = 54	24, 48 w	Heterogenic, mean age: 43 years, duration of CNSLBP: >12 month CNSLBP
Van Tilburg et al., 2022	MMS	Investigation of the feasibility of the e-Exercise NSLBP prototype for patients and physiotherapists to improve the intervention	five-point Likert scale	G1: n = 18 G2: n = 15 G3: n = 8	12 w	Heterogenic, mean age: 44.7, duration of pain: 0–6 w = 10%, 6–12 w = 12%, 12 w – 12 months = 22%
Verbrugghe et al., (2018)	RCT	Investigate the feasibility of HIT and to explore the magnitude of the effects of a HIT program on exercise capacity and disease related outcome measures compared to conventional therapy for persons with CNSLBP	Exercise diary (protocol)	G1: n = 10 G2: n = n 10	6 w after baseline	Heterogenic, mean age: 37 years, duration of CNSLBP: X
Wälti et al. (2015)	RCT	Analyzing patients' adherence and the evaluation of short-term effects on pain and disability of MMT when compared to usual PT	Recorded by Software	G1: n = 14 G2: n = 14	17 w	Heterogenic, mean age: 41.6 years, duration of CNSLBP: >3 month CNSLBP
Zadro et al., (2019)	RCT	Investigation of the effects of home-based video game exercises on pain SE and care seeking	Exercise diary	G1: n = 60 G2: n = 60	X	Heterogenic, mean age: 67.8 years, duration of CNSLBP: >3 month CNSLBP

CNSLBP = chronic non-specific back pain, CST = classification-specific treatment, EP = exercise program, G = group, HIT = high intensity training, LPMM = lumbopelvic motion monitor, MAI = multidimensional adherence index, MMS = mixed method study, NCT = non-classification specific treatment, NSLBP = non-specific low back pain, OS = observational study, PT = physiotherapy or physiotherapists, QS = qualitative study, RCT = randomized controlled trial, SIRAS = sport injuries rehabilitation adherence scale, w = weeks, < = less-than, > = greater-than.

A previously published systematic review (McLean et al., 2017) already highlighted that adherence was not measured adequately in PT settings. Counting the number of performed exercises more likely measures compliance than adherence. Compliance is defined as "a patient following the advice of a therapist or physician" (Gray et al., 2002), while adherence is defined as the patient's willingness to follow treatment recommendations agreed upon with the therapist to the best of his or her ability and empathy (McDonald et al., 2002). This reflects a model of shared decision-making in the therapist-patient relationship that is based on communication and feedback (Collado-Mateo et al., 2021; Lonsdale et al., 2017; Ritschl et al., 2020). This requires that the recommended exercises are confidence-building in that they do not elicit resistance, such as fear of failure, or fear of strain, but confidence; that the exercise program is individualized in terms of goals, resources (time, equipment, cost, etc.), and patient characteristics; that the scope of a program (design, ease of use), social support to increase willingness to perform the exercises, and smooth integration of the exercises into daily life are considered (Collado-Mateo et al., 2021; Jack et al., 2010; Kolt and McEvoy 2003). Patient motivation, social support, supervision during the exercise sessions, multidisciplinary healthcare, use of technology, enjoyment, and absence of unpleasant experiences, as well as education are additional factors influencing adherence (Collado-Mateo et al., 2021; Essery et al., 2017; Ritschl et al., 2020). Measuring adherence should be undertaken cautiously until acceptable evidence of essential measurement properties is established and greater clarity of the conceptual underpinning of each measure is provided (McLean et al., 2017). Future measurement tools need to capture more than the simple frequency of performed exercises by reflecting the multidimensional nature of patient adherence with as many influencing factors as possible, including e.g. patient motivation, the quality of the therapist-patient relationship, the comprehensibility of exercise programs, or the degree of fear of negative consequences.

The research question on the most effective strategy to facilitate adherence could not be answered because of the multitude of approaches including their duration and frequency as well as the type of intervention and non-comparable measurement tools. Approaches based on psychological strategies, such as COU (Alzahrani et al., 2021; Azevedo et al., 2021; Basler et al., 2007; Lenoir et al., 2019; Taulaniemi et al., 2020; Wälti et al., 2015) and CBT (Göhner and Schlicht 2006; Jay et al., 2015; Kerns et al., 2014) and strategies, based on communication, e.g., goal setting, motivation, and changing negative beliefs by developing a coping skill (Kolt and McEvoy 2003; Jack et al., 2010; WHO. World Health Organisation, 2003; Collado-Mateo et al., 2021; Bachmann et al., 2018; Essery et al., 2017; Ritschl et al., 2020) were most frequently evaluated and generally effective strategies. One example is the study by Azevedo et al. (2021) who used COU and achieved a 16% improvement in adherence between the first and the last measurement. It is important to note that in this study as well as all other studies included at stage 2, that COU was conducted in combination with other strategies. Only Lonsdale et al. (2017) used exclusively a specific communication style and achieved a 41% higher level of adherence in the group with COM. Another approach is based on digital applications in 3 studies (Hügli et al., 2015; Wälti et al., 2015; Zadro et al., 2019). Wälti et al. (2015) reached an 80% adherence rate in NSLBP patients with the group with DIT as the comparison group. In contrast, Zadro et al. (2019) achieved a 70.8% adherence rate in favor of the patients in the group with DIT. It should be noted that the DIT interventions were also always offered in combination with others types of intervention. The working mechanism might be different here and more relying on automatic reminder functions or the arousal of gaming interest because exercises offered as DIT are usually associated with challenges and rewards.

Important information on, how adherence can be increased, could be explained by the identification of barriers, which include difficulties in contacting care providers, lack of motivation and supportive environment, lack of self-discipline or time, forgotten exercises, difficult or non-effective exercises, patients' beliefs, the therapist-patient relationship, patient involvement, patient attitudes, cultural aspects, and language (Boutevillain et al., 2017; Cherkin et al., 2016; Lonsdale et al., 2017; Maas et al., 2015; Martin et al., 2005, Palazzo et al., 2016). It seems

Table 4
Characteristics of included studies to stage 2.

Strategies or tools to facilitate patients' adherence to physiotherapy						
Authors/ studies	Study design	Study objective	Tools or strategies	Participants per group (n)	Follow-up time (w)	Participant characteristics	Effects
Alzahrani et al., (2021)	RCT	Examination of feasibility and initial efficacy of a wearables-based walking intervention in addition to usual PT care	G1: EP (RS), MT, COU (education) and walking program	G1: n = 12	26 w	Heterogenic, mean age: 43.6 years, risk classification of chronicity > medium	**Adherence:** 67.1% to **walking program:** (depended on pain intensity and COU (education)
			G2: Usual PT (EP)	G2: n = 14		NSLBP	Correlation: Adherence (activity) and pain (r = .665, p = .026)
			Duration: 8 w (daily)				G1 in favor to G2 in pain reduction (p = .13) G1 in favor to G2 in physical activity (p = .012) Post intervention pain catastrophizing G1 > G2 (p = .006)
Azevedo et al., (2021)	RCT	Assessment of possible association between patient independence in performing 2 different HE programs	G1: COU (education), EP (stretching, RT) G2: EP (stretching, RT) Both: HP Duration: 8 w (2x/w – 4x/w)	G1: n = 67 G2: n = 70	X	Heterogenic, mean age: 41.3 years, duration of CNSLBP: >3 month CNSLBP	**Adherence:** G1 sig. > G2 to HP (16%) (p = .001) COU (education) = 16% more adherence
Basler et al., (2007)	RCT	Examining the outcome of COU in PT based on the TTM in a sample	G1: COU (increasing SE and at positively influencing decisional balance), G2: Placebo UST,	G1: n = 86	X	Heterogenic, mean age: 70 years, duration of CNSLBP: no data	**Adherence:** Physical activity (min. in average): G1: M1 = 15.98, M2 = 29.24, M3 = 29.63
			Both: PT (stretching, RT, mobility) Duration: 5 w (10 sessions)	G2: n = 84		CNSLBP	G2: M1 = 14.11, M2 = 24.7, M3 = 25.3 G2 = superior to G1, but not sign.
Coppack et al., (2012)	RCT	Examine the effects of a GS intervention on SE, adherence and treatment outcome	G1: GS (goals, priorities for rehabilitation) G2: SEP, motivation	G1: 16 G2: 16	Day 6 and 11	Heterogenic, 33 years (mean), all engaged in low intensity exercise prior to admission NSLBP	**Adherence:** SIRAS were sig. higher in G1 (p < .025) SIRAS scores: G1 (GS) = 15, G2 = 13.7, G3 = 12
			G3: SEP, monitoring exercise technique for safety Both: identical EP Duration: 3 w 5x/w	G3: 16			
Göhner and Schlicht (2006)	RCT	Investigate whether it is possible to transfer theory-based and evidence-based findings into practice of PT	G1: CBT (enhancing SE perceptions, reduce barrier perceptions and maximize severity perceptions) and EP G2: EP (RT, stretching, relaxation)	G1: n = 25	16 and 24 w after last PT session	Heterogenic, mean age:	**Adherence:** G1: ≥ 5x per w (M4) vs. G1: 1 – 4x per w to HP (= 17.5% in favor to G1 with CBT) SE: G1: M1 = 2.23 to M4 = 2.97 G2: M1 = 2.35 to M4 = 2.30
			Both: HP			duration of NSLBP: no data	Barriers: G1: M1 = 2.39 to M4 = 1.89 G2: M1 = 2.19 to M4 = 2.51
			Duration: 3x CBT, 6x EP	G2: n = 22		Subacute NSLBP	Severity: G1: M1 = 2.72 to M4 = 4.40 G2 M1 = 3.04 to M4 = 2.77
Hügli et al., (2015)	RCT	Exploration of the differences in HE adherence between patients who perform conventional exercises and those who exercise with AF	G1: DIT, EP (stabilization, MC), MT G2: EP, MT Duration: 28 w (daily HP)	G1: n = 10 G2: n = 10	X	Heterogenic, mean age: 35.9 years, duration of NSLBP: >4 weeks	**Adherence:** No sig. diff. adherence to HE per day G1: 544 s per day vs. G2: 249 s per day = 45.77% in favor of G1 (DIT) (p = .315)
Jay et al., (2015)	RCT	Investigation the effect of a multifaceted worksite intervention on pain and stress among laboratory technicians	G1: CBT (education, mindfulness) EP (MC, RT, MF G2: Followed standardized health initiatives Duration: 10 w (EP 4x/ w, CBT 1x/day)	G1: n = 56 G2: n = 56	10 w after baseline	Heterogenic, mean age: 46.5 years, duration of NSLBP: >3 month, Smokers: 10% CMSK	**Adherence:** Higher no. of EP were associated with reduced pain G1: Adherence to EP = 70% and to mindfulness 47.5% of intended sessions No data of adherence to G2
Kerns et al., 2014	RCT	Evaluation whether TCBT that incorporated preferences for learning specific cognitive and/or behavioral skills	G1: CBT (MI, reflection of maladaptive behaviors) G2: CBT (without MI) Both: CBT	G1: n = 68 G2: n = 60	15 weeks after last baseline assessment	Heterogenic, mean age: 55 years, duration of CNSLBP: >6 month CNSLBP	**Adherence:** G1 treatment participation (6.87) did not differ sig. from G2 (6.77) (p = .001)

Table 4 (*continued*)

Authors/ studies	Study design	Study objective	Tools or strategies	Participants per group (n)	Follow-up time (w)	Participant characteristics	Effects
			Strategies or tools to facilitate patients' adherence to physiotherapy				
Lenoir et al., 2019	RCT	Examining whether socio-demographic variables, pain or functionality are related to the degree of clinic-based therapy adherence	Duration: 14 w (10 sessions) G1: COU (PNSE education), CBT (CTET) G2: COU (biomedical back and neck education), EP (mobility, RT)	G1: n = 60	Immediately at the end of the treatment	Heterogenic, mean age: 40.6, duration of CNSLBP: >3 month	**Adherence:** no specific data to effectiveness of facilitation strategies G1: Demographic data (gender, age, education) influences adherence but not equal the actual therapy effect (P < .05 (0.016))
			Duration: 12 w (3 COU, 15x EP)	G2: n = 60		CNSLBP	G2: Educational level was associated with adherence on the last 50% of PT In G1 only association between change in KP and adherence was sig. (p = .004)
Lonsdale et al., 2017	RCT	Assessment of an intervention designed to enhance physiotherapists' COM skills on patients' adherence to recommendations regarding home-based rehabilitation	G1: COM, individual PT (GL) Both: individual PT care	G1: n = 124	1, 4, 12, 24 w	Heterogenic, mean age: 45.4, duration of CNSLBP: >3 month	**Adherence:** G1 patients' overall adherence were in average 41% > G2 (p = .01).
			Duration: no restrictions on the number of sessions G2: evidence based CNLBP management (GL)	G2: n = 131		CNSLBP	COM skills of PTs had short-term positive effects on patients' self-reported home-based adherence (w 1–12) but not on other adherence factors (p = .01), e.g., in-clinic adherence to back exercises
Mannion et al., 2009	PS	Examining factors associated with adherence and the relationship between adherence and outcome after a program of stabilization exercises.	One group: EP in 3 stages (1. RT, stabilization, 2. Specific abdominal contraction, 3. ADL performance), HP	1 G: n = 37	X	Heterogenic, mean age: 44 years, duration of CNSLBP >3 month	**Adherence to HP:** reduction in pain (Rho = .54, p = .003) and in disability (Rho = .38 to, p = .036) correlates
			Duration: 9 w (1x/w), HP daily			CNSLBP	Median scores for attendance (100%) (IQR 11%), commitment (SIRAS) 96% (IQR 8%) and adherence to home exercises (75%) (IQR 41%) Adherence (SIRAS, MAI) depends on SE (mean 47.4%) (Rho = 0.36, p = .045)
Ris et al., 2021	OS	Evaluation of participants' adherence to the intervention and identified characteristics related to the completion of GLA:D® Back. Specifically: 1) Investigation of participations' adherence level enrolled in the program 2) participant-related factors associated with low attendance	Groups were defined in sections:	G1: n = 392	12 w	Heterogenic, mean age: 59.5 years, duration of CNSLBP: most >12 month (59%)	**Adherence:** Strongest indicator for attendance and adherence was whether participants completed the baseline questionnaire or not, whereas individual baseline patient factors did not reveal any clear pattern (OR = 0.29) or fully (OR = 0.14) > duration of symptoms (disability) (OR = 1.87) (95% CI 0.47–7.36) = higher attendance
			Risk of chronicity:	G2: n = 420			
			G1: Low G2: Medium G3: High G4: Unknown All: GLA:D Back program: 2 educational and 16 supervised exercise sessions, to patients with NSLBP	G3: n = 918 G4: n = 665			
Taulaniemi et al., (2020)	RCT	Examination of which BPS factors contributed to exercise adherence during a 6-month neuromuscular exercise intervention, and to investigate how exercising affects FABs	G1: EP (MC, coordination, RT) G2: COU (education and EP via DVD)	G1: n = 58	24, 48w	Female, mean age: 46 years, health care workers, duration of pain:	**Adherence:** G1 and G2 = constantly low adherences (mean: 1.1 x per w) Low adherence = low education level (p = .026), shift work (p = .023), low aerobic (p = .048) and MSK pain (p = .043)
			Both: Motivation strategy (goals, exercises etc.)	G2: n = 52		NSLBP	No sig. diff. between groups in reduction of pain, physical activity and disability (p < .05).

Table 4 (*continued*)

Authors/ studies	Study design	Study objective	Tools or strategies	Participants per group (n)	Follow-up time (w)	Participant characteristics	Effects
			Strategies or tools to facilitate patients' adherence to physiotherapy				
Van Dillen et al., (2016)	RCT	Comparison of the efficacy of a CST and a NCT treatment and examine the moderating effect of adherence on outcomes	Duration: 8 w 2x/w (stage 1), 16 w 2x/w (stage 2,3) G1: Teaching movement optimization of LS, using other joints, avoiding end range position of LS posture during movement)	G1: n = 47	24, 48 w	Heterogenic, mean age: 43 years, duration of CNSLBP: >12 month	G1: less satisfaction with care after the treatment phase (p < .05) **Adherence:** G1 and G2 daily performance training adherence: 78% p = .03
			G2: POT (teaching posture during ADL) Duration: 6 w (1 session/w)	G2: n = 54		CNSLBP	Exercise adherence: daily in 79% (p = .56) G1 and G2 adherence rate correlated less more to performance training than to EP (.94 vs.96) G1 and G2 not differ in mean disability (p > .05)
Wälti et al., (2015)	RCT	Analyzing patients' adherence and the evaluation of short-term effects on pain and disability of MMT when compared to usual PT	G1: DIT, COU (education with "explain pain"), SRT, EP (MC), HP	G1: n = 14	17 w	Heterogenic, mean age: 41.6 years, duration of CNSLBP: >3 month	**Adherence:** >mean 80% in both groups
			G2: COU (standard education, EP (RT, MC, NM)	G2: n = 14			Pain reduction G1 > G2 (diff.1.45) (p = .03),
			Duration: 12 w (16 sessions)			CNSLBP	Reduction in disability (RMDQ): G1 = G2: (non-sig. diff.)
Zadro et al., (2019)	RCT	Investigation of the effects of home-based video game exercises on pain SE and care seeking	G1: DIT (Wi Fit, EP)	G1: n = 60	X	Heterogenic, mean age: 67.8 years, duration of CNSLBP: >3 month	**Adherence:** 70.8% (in total) and in favor to G1 after 8 (p. = .80), 12 (p = .63), 24 w (p = .96)
			G2: Usual EP for HP				SE: G1 > G2 but only at 24 w (diff.: 6.1%)
			Duration: 8 w (3x/w)	G2: n = 60		CNSLBP	Pain reduction: G1 in favor to G2 after 8 w (p = .29) Disability reduction: G1 in favor to G2 after 8 w (p = .21)

PT = physiotherapy, G = group, M = measurement, min. = minutes, w = weeks, ≤ less-than, ≥ greater-than, diff. = difference, TTM = transtheoretical model, RCT = randomized controlled trial, OS = observational study, PS = prospective study, CMSK = chronic musculoskeletal pain, MSK = musculoskeletal, CNSBP = chronic non-specific back pain, NSLBP = non-chronic low back pain, COU = counseling, CBT = cognitive behavioral therapy, RT = resistance training, COM = communication, GL = guideline, CVC = cardiovascular conditioning, CST = classification-specific treatment, NCT = non-classification specific treatment, POT = performance oriented training, ADL = activity of daily living, FAB = fear avoidance belief, CT = cognitive therapy, SRT = sensory retraining, NM = neuro mobilization, CTET = cognition-target exercise therapy, PNSE = pain neuroscience education, TCBT = TCBT = tailored cognitive-behavioral therapy, HE = home exercise, AF = augmented feedback, GLA:D back = evidence-based program consisting of patient education and supervised exercises, MAI = multidimensional adherence index, SE = self-efficacy, MI = motivational interviewing, DIT = digital intervention tool, MC = motor control, BPS = biopsychosocial, ODI = Oswestry Disability Index, GS = goal setting, SEP = standard exercise program, RMDQ = Roland Morris Disability Questionnaire, IQR = interquartile range, Rho = Spearman's rank correlation coefficient.

necessary to focus on strategies including these multiple dimensions (Bachmann et al., 2018, Collado-Mateo et al., 2021; Essery et al., 2017; Ritschl et al., 2020). This is important for physiotherapist education because knowledge of barriers to adherence does not automatically lead to better patient adherence (Maas et al., 2015). Patient-related factors, such as educational background, can potentially not be influenced, they can be assessed and may play a role in the choice of a strategy to facilitate adherence (George et al., 2021; Grabovac and Dorner, 2019; Hayden et al., 2019).

Options to facilitate adherence may therefore include psychological strategies, such as motivation or self-awareness, and education to understand the need for therapeutic and medical measures (Bell et al., 2007, De las Cuevas, 2011). But also exercise-related strategies such as the appropriate difficulty and intensity of exercise programs and the implementation of reminders (Mallett et al., 2020; McLean et al., 2017).

4.1. Limitations

Fewer RCTs existed on the topic than anticipated. Therefore, non-

RCTs were added to answer the 1st question on adherence-based measurement tools. Several studies implemented a strategy, e.g., goal setting, communication, and exercise programs but measured clinical effects (pain intensity or disability) rather than adherence. Or vice versa, a new exercise program was developed (e.g., not explicitly a strategy to increase adherence) and adherence was measured as a secondary outcome (usually exercise diary). Due to the small number of studies and the heterogeneity of data sets, a meta-analysis to provide an effect size for adherence was not possible. For the same reason, no funnel plots to investigate publication bias were produced.

5. Conclusion

The current review reveals a gap in the evidence on strategies to facilitate adherence in NSLBP populations and measurement tools that reach beyond the counting of exercise sessions.

The aim of future work should be to develop strategies and test their effectiveness on patient adherence, especially in NSLBP patients. This should include but not be limited to digital options. Furthermore,

measurement tools need to be evaluated for psychosocial properties that focus specifically on patients with back pain, are easy to use clinically, and incorporate the multidimensional aspects of adherence.

CRediT authorship contribution statement

A. Alt: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Visualization. **H. Luomajoki:** Methodology, Investigation, Resources. **K. Luedtke:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Resources, Visualization.

References

Areerak, K., Waongenngarm, P., Janwantanakul, P., 2021. Factors associated with exercise adherence to prevent or treat neck and low back pain: a systematic review. Muscoskel. Sci. Pract. 52, 102333 https://doi.org/10.1016/j.msksp.2021.102333.

Alzahrani, H., Mackey, M., Stamatakis, E., Shirley, D., 2021. Wearables-based walking program in addition to usual physiotherapy care for the management of patients with low back pain at medium or high risk of chronicity: a pilot randomized controlled trial. PLoS One 16 (8), e0256459. https://doi.org/10.1371/journal.pone.0256459.

Azevedo, D.C., Ferreira, P.H., de Oliveira Santos, H., Oliveira, D.R., Leite de Souza, J.V., Pena Costa, L.O., 2021. Association between patient independence in performing an exercise program and adherence to home exercise program in people with chronic low back pain. Muscoskel. Sci. Pract. 51, 102285 https://doi.org/10.1016/j.msksp.2020.102285.

Babatunde, F.O., MacDermid, J.C., MacIntyre, N., 2017. A therapist-focused knowledge translation intervention for improving patient adherence in musculoskeletal physiotherapy practice. Arch. Physiother. 7, 1. https://doi.org/10.1186/s40945-016-0029-x.

Bachmann, C., Oesch, P., Bachmann, S., 2018. Recommendations for Improving Adherence to Home-Based Exercise: A Systematic Review. Physik Med Rehab. Kuror. 28 (01), 20–31. https://doi.org/10.1055/s-0043-120527.

Basler, H.D., Bertalanffy, H., Quint, S., Wilke, A., Wolf, U., 2007. TTM-based counselling in physiotherapy does not contribute to an increase of adherence to activity recommendations in older adults with chronic low back pain–a randomised controlled trial. Eur. J. Pain 11 (1), 31–37. https://doi.org/10.1016/j.ejpain.2005.12.009.

Bell, J.S., Airaksinen, M.S., Lyles, A., Chen, T.F., Aslani, P., 2007. Concordance is not synonymous with compliance or adherence. Br. J. Clin. Pharmacol. 64 (5), 710–713. https://doi.org/10.1111/j.1365-2125.2007.02971_1.x.

Boutevillain, L., Dupeyron, A., Rouch, C., et al., 2017. Facilitators and barriers to physical activity in people with chronic low back pain: a qualitative study. PLoS One 12 (7), e0179826. https://doi.org/10.1371/journal.pone.0179826.

Chakrabarti, S., 2014. What's in a name? Compliance, adherence and concordance in chronic psychiatric disorders. World J. Psychiatr. 4 (2), 30–36. https://doi.org/10.5498/wjp.v4.i2.30.

Cherkin, D., Balderson, B., Brewer, G., 2016. Evaluation of a risk-stratification strategy to improve primary care for low back pain: the MATCH cluster randomized trial protocol. BMC Muscoskel. Disord. 17 (1), 361. https://doi.org/10.1186/s12891-016-1219-0.

Collado-Mateo, D., Lavín-Pérez, A.M., Peñacoba, C., Del Coso, J., Leyton-Román, M., Luque-Casado, A., Gasque, P., Fernández-Del-Olmo, M.Á., Amado-Alonso, D., 2021. Key factors associated with adherence to physical exercise in patients with chronic diseases and older adults: an umbrella review. Int. J. Environ. Res. Publ. Health 18 (4), 2023. https://doi.org/10.3390/ijerph18042023.

Coppack, R.J., Kristensen, J., Karageorghis, C.I., 2012. Use of a goal setting intervention to increase adherence to low back pain rehabilitation: a randomized controlled trial. Clin. Rehabil. 26 (11), 1032–1042. https://doi.org/10.1177/0269215512436613.

Cumpston, M., Li, T., Page, M.J., Chandler, J., Welch, V.A., Higgins, J.P., Thomas, J., 2019. Updated guidance for trusted systematic reviews: a new edition of the Cochrane Handbook for Systematic Reviews of Interventions. Cochrane Database Syst. Rev. 10, ED000142. https://doi.org/10.1002/14651858.ED000142.

De las Cuevas, C., 2011. Towards a clarification of terminology in medicine taking behavior: compliance, adherence and concordance are related although different terms with different uses. Curr. Clin. Pharmacol. 6 (2), 74–77. https://doi.org/10.2174/157488411796151110.

Downs, S.H., Black, N., 1998. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J. Epidemiol. Community 52 (6), 377–384. https://doi.org/10.1136/jech.52.6.377.

Essery, R., Geraghty, A.W., Kirby, S., Yardley, L., 2017. Predictors of adherence to home-based physical therapies: a systematic review. Disabil. Rehabil. 39 (6), 519–534. https://doi.org/10.3109/09638288.2016.1153160.

George, S.Z., Fritz, J.M., Silfies, S.P., Schneider, M.J., Beneciuk, J.M., Lentz, T.A., Gilliam, J.R., Hendren, S., Norman, K.S., 2021. Interventions for the management of acute and chronic low back pain: revision 2021. J. Orthop. Sports Phys. Ther. 51 (11), CPG1–CPG60. https://doi.org/10.2519/jospt.2021.0304.

Göhner, W., Schlicht, W., 2006. Preventing chronic back pain: evaluation of a theory-based cognitive-behavioural training programme for patients with subacute back

pain. Patient Educ. Counsel. 64 (1–3), 87–95. https://doi.org/10.1016/j.pec.2005.11.018.

Grabovac, I., Dorner, T.E., 2019. Association between low back pain and various everyday performances : activities of daily living, ability to work and sexual function. Wien Klin. Wochenschr. 131 (21–22), 541–549. https://doi.org/10.1007/s00508-019-01542-7.

Gray, R., Wykes, T., Gournay, K., 2002. From compliance to concordance: a review of the literature on interventions to enhance compliance with antipsychotic medication. J. Psychiatr. Ment. Health Nurs. 9 (3), 277–284. https://doi.org/10.1046/j.1365-2850.2002.00474.x.

Hayden, J.A., Wilson, M.N., Riley, R.D., Iles, R., Pincus, T., Ogilvie, R., 2019. Individual recovery expectations and prognosis of outcomes in non-specific low back pain: prognostic factor review. Cochrane Database Syst. Rev. 2019 (11), CD011284. https://doi.org/10.1002/14651858.CD011284.pub2.

Hügli, A.S., Ernst, M.J., Kool, J., Rast, F.M., Rausch-Osthoff, A.K., Mannig, A., Oetiker, S., Bauer, C.M., 2015. Adherence to home exercises in non-specific low back pain. A randomised controlled pilot trial. J. Bodyw. Mov. Ther. 19 (1), 177–185. https://doi.org/10.1016/j.jbmt.2014.11.017.

Jack, K., McLean, S.M., Moffett, J.K., Gardiner, E., 2010. Barriers to treatment adherence in physiotherapy outpatient clinics: a systematic review. Man. Ther. 15 (3), 220–228. https://doi.org/10.1016/j.math.2009.12.004.

Jay, K., Brandt, M., Hansen, K., Sundstrup, E., Jakobsen, M.D., Schraefel, M.C., Sjogaard, G., Andersen, L.L., 2015. Effect of individually tailored biopsychosocial workplace interventions on chronic musculoskeletal pain and stress among laboratory technicians: randomized controlled trial. Pain Physician 18 (5), 459–471.

Kerns, R.D., Burns, J.W., Shulman, M., Jensen, M.P., Nielson, W.R., Czlapinski, R., Dallas, M.I., Chatkoff, D., Sellinger, J., Heapy, A., Rosenberger, P., 2014. Can we improve cognitive-behavioral therapy for chronic back pain treatment engagement and adherence? A controlled trial of tailored versus standard therapy.Health psychology: official journal of the Division of Health Psychology. Am. Psychol. Assoc. 33 (9), 938–947. https://doi.org/10.1037/a0034406.

Kolt, G.S., McEvoy, J.F., 2003. Adherence to rehabilitation in patients with low back pain. Man. Ther. 8 (2), 110–116. https://doi.org/10.1016/s1356-689x(02)00156-x.

Kongsted, A., Ris, I., Kjaer, P., Hartvigsen, J., 2021. Self-management at the core of back pain care: 10 key points for clinicians. Braz. J. Phys. Ther. 25 (4), 396–406. https://doi.org/10.1016/j.bjpt.2021.05.002.

Lenoir, D., Coppieters, I., Willaert, W., Kregel, J., Danneels, L., Cagnie, B., Meeus, M., Nijs, J., Malfliet, A., 2019. Do sociodemographic features, pain sensitivity or pain catastrophizing relate to clinic-based adherence to physiotherapy in people suffering from chronic spinal pain? Secondary analysis of a randomized clinical trial. Muscoskel. Sci. Pract. 44, 102066 https://doi.org/10.1016/j.msksp.2019.102066.

Lonsdale, C., Hall, A.M., Murray, A., Williams, G.C., McDonough, S.M., Ntoumanis, N., Owen, K., Schwarzer, R., Parker, P., Kolt, G.S., Hurley, D.A., 2017. Communication skills training for practitioners to increase patient adherence to home-based rehabilitation for chronic low back pain: results of a cluster randomized controlled trial. Arch. Phys. Med. Rehabil. 98 (9), 1732–1743.e7. https://doi.org/10.1016/j.apmr.2017.02.025.

Maas, M.J., van Dulmen, S.A., Sagasser, M.H., Heerkens, Y.F., van der Vleuten, C.P., Nijhuis-van der Sanden, M.W., van der Wees, P.J., 2015. Critical features of peer assessment of clinical performance to enhance adherence to a low back pain guideline for physical therapists: a mixed methods design. BMC Med. Educ. 15, 203. https://doi.org/10.1186/s12909-015-0484-1.

Macedo, L.G., Richardson, J., Battie, M.C., Hancock, M., Kwan, M., Hladysh, G., Zhuo, L., 2021. Back to living well: community-based management of low back pain: a feasibility study. Pilot and feasibility studies 7 (1), 134. https://doi.org/10.1186/s40814-021-00863-7.

Mallett, R., McLean, S., Holden, M.A., Potia, T., Gee, M., Haywood, K., 2020. Use of the nominal group technique to identify UK stakeholder views of the measures and domains used in the assessment of therapeutic exercise adherence for patients with musculoskeletal disorders. BMJ Open 10 (2), e031591. https://doi.org/10.1136/bmjopen-2019-031591.

Mannion, A.F., Helbling, D., Pulkovski, N., Sprott, H., 2009. Spinal segmental stabilisation exercises for chronic low back pain: programme adherence and its influence on clinical outcome. European spine journal : official publication of the European Spine Society. the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society 18 (12), 1881–1891. https://doi.org/10.1007/s00586-009-1093-7.

Martin, L.R., Williams, S.L., Haskard, K.B., Dimatteo, M.R., 2005. The challenge of patient adherence. Therapeut. Clin. Risk Manag. 1 (3), 189–199.

McDonald, H.P., Garg, A.X., Haynes, R.B., 2002. Interventions to enhance patient adherence to medication prescriptions: scientific review. JAMA 288 (22), 2868–2879. https://doi.org/10.1001/jama.288.22.2868.

McLean, S., Holden, M.A., Potia, T., Gee, M., Mallett, R., Bhanbhro, S., Parsons, H., Haywood, K., 2017. Quality and acceptability of measures of exercise adherence in musculoskeletal settings: a systematic review. Rheumatology 56 (3), 426–438. https://doi.org/10.1093/rheumatology/kew422.

Nkhata, L.A., Brink, Y., Ernstzen, D., Louw, Q.A., 2019. A systematic review on self-management education campaigns for back pain. S. Afr. J. Physiother. 75 (1), 1314. https://doi.org/10.4102/sajp.v75i1.1314.

Ouzzani, M., Hammady, H., Fedorowicz, Z., Elmagarmid, A., 2016. Rayyan-a web and mobile app for systematic reviews. Syst. Rev. 5 (1), 210. https://doi.org/10.1186/s13643-016-0384-4.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S., McGuinness, L.A., Moher, D., 2021. The PRISMA 2020 statement: an

updated guideline for reporting systematic reviews. BMJ (Clinical research ed.) 372, n71. https://doi.org/10.1136/bmj.n71.

Palazzo, C., Klinger, E., Dorner, V., et al., 2016. Barriers to home-based exercise program adherence with chronic low back pain: patient expectations regarding new technologies. Ann. Phys. Rehabil. Med. 59 (2), 107–113. https://doi.org/10.1016/j.rehab.2016.01.009.

Peek, K., Carey, M., Mackenzie, L., Sanson-Fisher, R., 2019. Patient adherence to an exercise program for chronic low back pain measured by patient-report, physiotherapist-perception and observational data. Physiother. Theor. Pract. 35 (12), 1304–1313. https://doi.org/10.1080/09593985.2018.1474402.

Ris, I., Broholm, D., Hartvigsen, J., Andersen, T.E., Kongsted, A., 2021. Adherence and characteristics of participants enrolled in a standardised programme of patient education and exercises for low back pain, GLA:D® Back - a prospective observational study. BMC Muscoskel. Disord. 22 (1), 473. https://doi.org/10.1186/s12891-021-04329-y.

Ritschl, V., Stamm, T.A., Aletaha, D., et al., 2020. Prevention, screening, assessing and managing of non-adherent behaviour in people with rheumatic and musculoskeletal diseases: systematic reviews informing the 2020 EULAR points to consider. RMD Open 6 (3), e001432. https://doi.org/10.1136/rmdopen-2020-001432.

Roodbeen, R., Vreke, A., Boland, G., Rademakers, J., van den Muijsenbergh, M., Noordman, J., van Dulmen, S., 2020. Communication and shared decision-making with patients with limited health literacy; helpful strategies, barriers and suggestions for improvement reported by hospital-based palliative care providers. PLoS One 15 (6), e0234926. https://doi.org/10.1371/journal.pone.0234926.

Saner, J., Bergman, E.M., de Bie, R.A., Sieben, J.M., 2018. Low back pain patients' perspectives on long-term adherence to home-based exercise programmes in physiotherapy. Muscoskel. Sci. Pract. 38, 77–82. https://doi.org/10.1016/j.msksp.2018.09.002.

Sharma, S., Jensen, M.P., Moseley, G.L., Abbott, J.H., 2019. Results of a feasibility randomised clinical trial on pain education for low back pain in Nepal: the Pain Education in Nepal-Low Back Pain (PEN-LBP) feasibility trial. BMJ Open 9 (3), e026874. https://doi.org/10.1136/bmjopen-2018-026874.

Taulaniemi, A., Kankaanpää, M., Rinne, M., Tokola, K., Parkkari, J., Suni, J.H., 2020. Fear-avoidance beliefs are associated with exercise adherence: secondary analysis of

a randomised controlled trial (RCT) among female healthcare workers with recurrent low back pain. BMC sports science, medicine & rehabilitation 12, 28. https://doi.org/10.1186/s13102-020-00177-w.

Tricco, A.C., Lillie, E., Zarin, W., O'Brien, K.K., Colquhoun, H., Levac, D., Moher, D., Peters, M.D.J., Horsley, T., Weeks, L., Hempel, S., Akl, E.A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M.G., Garritty, C., Lewin, S., et al., 2018. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann. Intern. Med. 169 (7), 467–473. https://doi.org/10.7326/M18-0850.

Van Dillen, L.R., Norton, B.J., Sahrmann, S.A., Evanoff, B.A., Harris-Hayes, M., Holtzman, G.W., Earley, J., Chou, I., Strube, M.J., 2016. Efficacy of classification-specific treatment and adherence on outcomes in people with chronic low back pain. A one-year follow-up, prospective, randomized, controlled clinical trial. Man. Ther. 24, 52–64. https://doi.org/10.1016/j.math.2016.04.003.

Van Tilburg, M., Kloek, C., Staal, J.B., Bossen, D., Veenhof, C., 2022. Feasibility of a stratified blended physiotherapy intervention for patients with non-specific low back pain: a mixed methods study. Physiother. Theor. Pract. 38 (2), 286–298. https://doi.org/10.1080/09593985.2020.1756015.

Verbrugghe, J., Agten, A., O Eijnde, B., Olivieri, E., Huybrechts, X., Seelen, H., Vandenabeele, F., Timmermans, A., 2018. Feasibility of high intensity training in nonspecific chronic low back pain: a clinical trial. J. Back Musculoskelet. Rehabil. 31 (4), 657–666. https://doi.org/10.3233/BMR-170810.

Wälti, P., Kool, J., Luomajoki, H., 2015. Short-term effect on pain and function of neurophysiological education and sensorimotor retraining compared to usual physiotherapy in patients with chronic or recurrent non-specific low back pain, a pilot randomized controlled trial. BMC Muscoskel. Disord. 16, 83. https://doi.org/10.1186/s12891-015-0533-2.

WHO. World Health Organisation, 2003. Adherence to Long Term Therapies – Evidence for Action. WHO Library Cataloguing-in-Publication Data.

Zadro, J.R., Shirley, D., Simic, M., Mousavi, S.J., Ceprnja, D., Maka, K., Sung, J., Ferreira, P., 2019. Video-game-based exercises for older people with chronic low back pain: a randomized controlledtable trial (GAMEBACK). Phys. Ther. 99 (1), 14–27. https://doi.org/10.1093/ptj/pzy112.

Taylor & Francis
Taylor & Francis Group

Check for updates

How do non-specific back pain patients think about their adherence to physiotherapy, and what strategies do physiotherapists use to facilitate adherence? A focus group interview study

A Alt[a], H Luomajoki[b], K Roese[c] and K Luedtke[a]

[a]Department of Physiotherapy, Universität zu Lübeck, Institute of Health Sciences, Lübeck, Germany; [b]Institute of physiotherapy, Zürich University of applied Sciences ZHAW, Winterthur, Switzerland; [c]Department of Occupational Therapy, Universität zu Lübeck, Institute of Health Sciences, Lübeck, Germany

ABSTRACT

Background: Long-term effectiveness of physiotherapy (PT) for low back pain (LBP) depends on the adherence of patients. Objectives: (1) Identify aspects associated with the adherence of patients with LBP to physiotherapy, and (2) identify factors to facilitate adherence of patients with LBP to PT.

Method: Focus group interviews were conducted with 10 patients with LBP (n = 10, 5 women) and 11 physiotherapists (5 women) from Germany and Switzerland, treating patients with LBP. Data analysis was based on structured content analysis. Deductive and inductive categories were identified and coded.

Results: Patients with LBP requested more and effective home programs, long-term rehabilitation management, and individualized therapy to achieve a higher level of adherence. Physiotherapists requested more time for patient education. Communication, quality of the therapist-patient relationship, and individualized therapy were identified as essential factors by both representatives.

Conclusion: Patients and physiotherapists identified aspects contributing to adherence. These may guide the development of multidimensional measurement tools for adherence. In addition, this information can be used to develop PT approaches to facilitate the level of adherence.

Introduction

Managing low back pain (LBP) is a multidimensional treatment process addressing cognition, function, and pain to reach long-lasting effects and reduce the risk of chronicity [1,2]. The level of program adherence is essential for the long-term management of non-specific musculoskeletal pain [2,3]. For the self-management of patients, a high level of adherence is needed [4]. The term 'adherence' replaces the formerly used concept of 'compliance' describing whether patients follow the advice of the physician or healthcare professional. Adherence is based on intrinsic motivation [5–7] and is often measured by counting the frequency and duration of home exercise performance or medication use or the number of attended treatment sessions, or by assessing behavior change [8]. Adherence to physiotherapy (PT) and PT-based home programs (HP), e.g. specific exercises, requires multifaceted behavior change. Issues such as a lack of motivation, need to be considered before they turn into barriers [9–13]. Furthermore, the professional knowledge of physiotherapists and their beliefs may influence the adherence of patients to PT. This includes the knowledge and use of national care guidelines, communication competencies, and behavior change strategies [14–17].

Current evidence supports that patient adherence can be influenced positively and negatively and that different treatment strategies may have different effects on adherence [9–17]. In a previously conducted systematic review, our workgroup found that no tools for the measurement of adherence exist, which capture its multidimensional nature. The multidimensional measurement is based on the biopsychosocial approach, such as the motivation of the patients, their trust in the PT, and the quality of the therapist-patient relationship, but also the comprehensibility of the exercises, enough appointments, etc. The most common way of measuring adherence in patients with LBP was by counting and recording exercise sessions, e.g. in diaries. The review also highlighted that no specific strategies have been developed, yet, that specifically facilitate the adherence of patients with LBP to PT [18]. A specific strategy to facilitate adherence in patients with LBP is based on the high relevance of psychosocial factors in back pain and expertise appropriate for LBP [1,2]. In other studies,

the locus of control (LOC) has also been shown to influence adherence [19,20]. In PT patients, the internal locus of control (ILC) means that they are motivated to perform exercises and accept the recommendations of the physiotherapist. External locus of control (ELC) represents the expectation of patients to avoid active approaches, which may increase the risk for a PT dependency [20,21].

This current study aimed (1) to identify aspects associated with the adherence of patients with LBP to physiotherapy, and (2) to identify factors to facilitate adherence of patients with LBP to PT.

Methods

Focus group interviews based on a qualitative research approach were chosen to explore the perspectives of patients with LBP and physiotherapists. For study development, we used the COREC checklist [22]. The ethics committee of the University of Lübeck approved the study protocol (registration no.: 2022–457). The study protocol was registered on Open Science Framework: https://osf.io/48jhv/.

Qualitative research was used because there was a lack of sufficient research on this topic [23]. The focus group discussion allows for group dynamics that can lead to clarification of individual arguments, opinions, beliefs, and expectations that can be beneficial to understanding the research subject. For this purpose, a total of two focus groups were formed, consisting of either physiotherapists (PTG) ($n = 11$) or patients with LBP (PG) ($n = 10$). If the number of participants was too high, the risk of data loss would increase due to the possible dominance of some, and less speaking-up of other participants [24]. The interviews were semi-structured and followed a predesigned interview guide.

Sampling and recruitment

Patients were informed of the study by flyers placed in participating PT centers and physiotherapists were recruited via digital flyers posted in PT groups on social media. The PG included 10 patients from four PT centers in Switzerland and Germany with different characteristics (Table 1). Different recruitment centers were chosen to increase the diversity of responses. LBP was defined as lumbar pain that has been constant or recurrent for at least six months [1]. Exclusion criteria were patients with red flags, e.g. tumors, neurological diseases, spinal diseases, such as ankylosing spondylitis, the use of other therapies and medications, and patients suffering from cognitive or mental disorders.

Physiotherapists were recruited, who treat patients with LBP regularly and have at least two years of clinical experience in the musculoskeletal field. This was regarded as a sufficient period of professional experience to develop patient adherence strategies. The PTG included 11 physiotherapists with different characteristics from the same centers as the patients (Table 2).

We expected that different opinions would prevail in the context of adherence of patients with LBP, e.g. between older/younger, active/non-active, or male/female patients with more acute/chronic back pain. Regarding the activity level of the patients, it should be noted that active patients are also likely to have fewer problems performing their HPs (Table 1). Among physiotherapists, it was expected that professional experience and preferences toward passive or active treatment approaches might influence responses. Therefore, it was taken care to include physiotherapists with heterogeneity regarding e.g. age, gender, duration of symptoms, and experience in treating patients with LBP (Table 2).

Data collection methods

Data were collected between the first of October and the twelfth of November 2022. The focus group interviews were planned as face-to-face group discussions in PT clinics or digitally via Webex audio meetings. The participants could choose which version they preferred. All participants have chosen the digital setting. Only audio recordings were used. Consent forms and information were emailed to participants before the start of the research project for full disclosure. The interviewer used an interview guide to ask all questions related to the predefined aspects. The task of the interviewer was to encourage the participants to interact in the discussion and formulate their opinions. Interaction between the participants was encouraged.

The interview guide was semi-structured and focused on the goal of the conversation. For this purpose, introductory questions and guideline questions were prepared in advance. In addition, ad hoc and prompting questions were asked. The interviewer attempted to generate episodic knowledge with regular narrative prompts [25].

After the interviews were conducted, the interviewer immediately filled out an interview protocol in which self-perception, situational aspects of the interview, conversation content before and after the interview, the focus within the interview, initial interpretation ideas, and special features were recorded.

Data analysis

A simple transcription system was used, as the focus was on the content of the data [26]. The analysis was based on predefined deductive categories which were derived from the existing literature and previously unknown inductive categories [27] (Table 3). Different

Table 1. Characteristics of patients with low back pain.

ID	Age (y)	Gender	Profession	Position	Professional qualification	Duration of LBP (month)	Other complaints	Smoker	Sport activity	Children (ages in years)	In a relationship
P01	53	f	Teaching	Employee	Diploma	Recurrent	Epicondylitis	No	≥1/w	17, 22, 24	Yes
P02	34	f	Office	Team Leader	B.Sc.	≥6	None	No	<3/w	None	Yes
P03	38	f	Office	Employee	M.Sc.	Recurrent	None	No	≤3	7, 7, 3	Yes
P04	33	m	Office	Manager	M.Sc.	Recurrent	Asthma	Yes	≥1/w	3	Yes
P05	24	f	Office	Public Health	B.Sc.	Recurrent	None	No	≤3	None	No
P06	34	m	Office	Employee	Diploma	Recurrent	None	No	≥1/w	1, 6, 11	Yes
P07	60	m	Office	Self-employed	M.Sc.	Recurrent	None	Yes	≥1/w	28, 31	No
P08	28	m	Education	Student/employee	B.Sc.	≤1	None	No	≤3/w	None	No
P09	41	m	Other	Self-employed	Diploma	Recurrent	Shoulder and knee pain	No	≤3/w	18, 10, 3	Yes
P10	26	f	Other	Employee	B.Sc.	Recurrent	None	No	≤3/w	None	Yes

B.Sc. = Bachelor of Science; f = female; LBP = low back pain; m = male; M.Sc. = Master of Science; w = week; y = years.

Table 2. Characteristics of physiotherapists.

PTG1	Age (y)	Gender	Qualification	Experience as a physiotherapist (years)	Position	Setting	Postgraduate Training
PTG01	31	f	B.Sc.	<5	Employee	Private practice	BWT (KGG)
PTG02	38	m	Diploma	>10	Employee	Private practice	COM, CBT, EP, MC, BWT
PTG03	38	f	B.Sc.	>10	Self-employed	Private practice	COM, MI
PTG03	36	f	M.Sc.	>10	Employee	Private practice	BWT, MC
PTG04	23	m	Diploma	<5	Employee	Private practice	COM, MI
PTG05	38	f	Diploma	>10	Self-employed	Private practice	COM
PTG06	28	f	B.Sc.	<5	Employee	Rehabilitation Center	None
PTG07	25	m	Diploma	<5	Employee	Private practice	COM, MI
PTG08	50	m	M.Sc.	>10	Self-employed	Private practice	COM, MI, EP, MC, BWT
PTG09	25	m	Diploma	<5	Employee	Private practice	None
PTG10	32	m	Diploma	>5	Self-employed	Private practice	COM, CBT, EP, BWT

B.Sc. = Bachelor of Science; BWT = functional movement therapy; COM = communication; EP = explain pain; f = female; KGG = machine assisted training; LBP = low back pain; *m* = male; MC = motor control; MI = motivational interviewing; M.Sc. = Master of Science.

patient or physiotherapist-related aspects observed in the data (e.g. the expectation of a patient with LBP in the category 'ILC') helped to define the deductive categories (Table 3).

Each statement was coded to fit into either one of the predefined deductive categories or used to develop a new inductive category (Table 3). When different words contained the same word sense in their respective contexts, such as 'digital therapy programs' and 'apps,' 'motivation' and 'desire,' 'evidence' and 'science,' 'massage' and 'manual therapy', they were assigned to the same category. Evaluative words that could also be understood as an accusation or provocation were not considered in the data analysis. In such cases, the statement was not used for agreement with a deductive category or to identify an inductive category. Irrelevant words that had no meaning for the research questions were ignored.

The entire research process was continuously reflected by the researchers involved.

The inductive categories that emerged, were based on responses of the interviewed participants which did not fit into the deductive categories. These included: criticism of the patients toward their physiotherapists or physiotherapists being concerned about treatment expectations raised by other healthcare professionals. For this purpose, the transcript was used as well as field notes, and recurring information on the same topic was recorded in a log (protocol). Only statements and categories related to their influence on the adherence of patients with LBP were used for category building.

Results

Patient group results

In the PG (*n* = 10, 5 women), eight patients had recurrent back pain, one had a duration of pain of more than six months and one had back pain for less than one month. Five patients worked in an office, two were employees. The average age was 37.5 years (Table 1).

Overall, there was almost homogeneous participation (all participants answered all questions). There were rarely contradictions among the participants but sometimes additions were offered to the answers and experiences of one or more participants. All deductive categories detailed in Table 3 were identified in the group discussion.

The patients explained that the willingness to accept effort on the part of the PT was important in promoting their ILC. They stated, *'When I go to PT, I want explanations to understand my problem and methods I can use myself to relieve my back pain.'*

Table 3. Predefined deductive categories.

Aspects	Categories	References
Predefined deductive aspects and categories for patients		
Motivation, reminders, expectation	External locus of control (ELC)	[19–21]
	Internal locus of control (ILC)	[19–21]
Therapist – patient, patient-doctor	Cooperation	[9,12,]
Insurance, institution	Circumstances/bureaucracy	[6]
Therapy program, HP	Therapy content	[18,28,]
Assistance from people (e.g. colleagues, family)	Social situation	[11,13,29,,]
Predefined deductive aspects and categories for physiotherapists		
Motivation, courage, relevance	Ambition	[12,13,]
Evidence, knowledge of guidelines, intuition, clinical relevance	Knowledge	[14–18,,,,]
MT, active therapy, CBT	Professional orientation	[16]
Therapist – patient, motivation of patients, expectation of patients	Relationship	[9,12,]
Insurance, social support, leadership	Management	[11,13,29,,]

B.Sc. = bachelor of science; CBT = cognitive behavioral therapy; ELC = external locus of control; HP = home program; ILC = internal locus of control; M.Sc. = master of science; MT = manual therapy.

In the context of ELC, the participants also clarified their expectations of PT, stating, *'I think my physiotherapist needs to fix my back until it's pain-free before I can do anything else.'*

The participants indicated that the quality of the relationship between them and their physiotherapists was important to implement the recommendations of the physiotherapist. They stated that competence and seriousness were relevant to relationship quality, *'I want a competent physiotherapist who listens to me and respects me and my problems.'*

The patients indicated that the simplicity of the exercises and the comprehensibility of the information and recommendations provided by the physiotherapist helped them to stay adherent. They stated, *'If I feel overwhelmed by the therapy content, I lose confidence in my therapist and reduce the practice of PT suggestions, like HP.'*

Various and regularly adjusted HP helped the patients to stay adherent in the long term. They said, *'The variation of exercises and methods within the PT or the HP keeps me more motivated to do it.'*

Six inductive categories: implementation of recommendations, the critical comments of patients with LBP about their physiotherapists, patient concerns about HP, perseverance in the PT process, the job situation of patients with LBP, and digitalization were extracted from the data.

a) Implementation of recommendations

This inductive category was developed mainly from patient responses to questions about the HP. Arguments from the patients consistently referred to the 'simplicity' of the exercises and, in addition, to the feasibility of implementation in terms of time. They stated, *'I find the exercise quite difficult and can't remember how to practice it perfectly at home. I need more practice time and explanation to optimize it.'*

For the long-term adherence to recommendations from the PT, 'variations' (versatility) were explained as relevant to keep up the motivation. One of the participants stated that recommendations from PT on behavioral changes regarding professional and/or personal life were never given. 'Pain increase' during PT and HP was also frequently stated as a limiting criterion.

b) Critical comments of patients with LBP about their physiotherapists

The patients stated frustration about their PT, *'I've never had an HP! I often feel like I am being treated on an assembly line. There were no goals formulated. I did not receive methods that suited my personal situation. I miss an effective and well-controlled aftercare program.'* These aspects also influenced the motivation of patients for their HP, if provided. Some patients also criticized the lack of questions from the therapists, such as how they would cope with the HP or what exactly is important to them.

c) Patient concerns about HP

A statement representing this category was, *'In the PT, I am often worried about the time pressure. If I do not know whether I am doing my exercises or my HP correctly, I worry that I will hurt myself or the pain will get worse. Hence, I prefer not to do it.'* These worries influenced patients' adherence negatively because it stopped them from practicing their HP. Participants mentioned additionally that a lack of therapy time increased their worry about misunderstanding exercises or recommendations.

d) Perseverance in the PT process

This inductive category was illustrated by statements from patients who requested more individualized load management, and exercises that fit into their professional and home life. They said, *'For a long-lasting participation in PT and a long-term practice of the HP, I need load-management adapted to me and my lifestyle, e.g. my preferred sports. I often lack the ability to integrate exercises or recommendations from my physiotherapist into my professional and personal life.'*

e) Job situation

The inductive category job situation was discussed at length, especially by those participants working in an office. The patients explained that workplace factors such as ergonomic equipment, time off for medical appointments, and prevention programs influenced their adherence. They stated, *'If I could just get time off for PT for acute back pain, I would find that helpful to realize PT. In my work, there are prevention programs for back pain, but they tend to have a half-hearted approach.'*

f) Digitalization

None of the respondents had experience with digital therapy programs, but all agreed that they would use it if it was varied, effective against their back pain, and easy to implement. The participants could imagine digital programs to be beneficial for their adherence to HP. However, important properties of such software programs were proposed: data volume (memory space) was an issue, as well as the variation of the content, and the reminder function. They stated, *'For me, apps are interesting and I think they would also have great potential in PT, especially for staying motivated and sustaining effectiveness.'*

Physiotherapist group results

In the PTG (*n* = 11, 5 women), the participants had an average experience of treating patients with LBP of more than eight years. Five had an academic degree, all worked in a private PT center and the average age was 33 years (Table 2).

All participants engaged in the discussion. There was often agreement on responses and a high level

of expertise was demonstrated because all answers indicated a good knowledge of patient adherence. All deductive categories that were anticipated prior to the focus group discussions emerged during the interviews (Table 3).

The physiotherapists indicated that evidence is the most relevant component of professional competence. They stated, *'For me, expertise consists of knowledge of national healthcare guidelines and evidence.'* In addition, the benefits of using expertise from other disciplines were explained, *'I use information from other disciplines related to adherence, such as psychology, to enhance my knowledge'.*

Most of physiotherapists preferred active PT to treat patients with LBP, at least toward the end of PT. They stated, *'Primary, I use active strategies to treat patients with LBP and if that is not completely possible, I supplement with manual techniques. If patients have too high expectations for passive therapy, I start my therapy with manual techniques.'*

The psychosocial approach was mentioned in relation to the management of PT. Participants indicated that these optimize the adherence of patients to PT and, in the long term, to HP. They stated, *'It's important to understand how the patients think and what beliefs guide them. Once I figure that out, I can motivate the patients individually to improve their sustainability in PT.'*

There were five inductive categories: elements facilitating adherence, treatment expectations raised by other health professionals, leadership quality of physiotherapists, communication in PT, and use of digital applications.

a) Elements facing adherence

The physiotherapists explained that goal setting, trust building, respecting the level of disability, and asking patients about expectations from PT are relevant strategies to facilitate adherence of patients with LBP. They stated, *'In my opinion, the basis for adherence is building confidence, a relationship, sympathy, goal setting, and assessing the patient's level of disability.'* The physiotherapists suggested documenting therapy success to stimulate adherence and to use questionnaires to promote reflection, asking questions for a better understanding of barriers. They argued, *'The most important thing for adherence is to read between the lines and to listen to what the patient is saying. For me, adherence-enhancing therapy includes a lot of education, coaching, and communication'.* They further perceived themselves as role models for e.g. an active lifestyle.

b) Other health professionals influencing expectations from treatment

This inductive category was based on statements from physiotherapists, that LBP patients were influenced by other PT colleagues and physicians who limited the trust of patients in their PT. They argued, *'My ambitions drop when patients believe their doctors more than me and think they would know everything better.'* Sometimes also family members or other peers can make it difficult for patients to remain adherent to PT. This creates difficult situations for the PT. The physiotherapists stated, *'If patients have been given wrong advice from a scientific point of view and are suffering from those wrong beliefs, I always try to talk to the responsible person about it.'*

d) Leadership quality of physiotherapists

This inductive category was developed following statements about the importance of teaching patients and showing them expertise as physiotherapists to reduce negative or false expectations. Participants reported that negative expectations and ill beliefs negatively influence adherence. They stated, *'I think, it is not only the expectation of the patients but also the expectation from us to the patients that create adherence based on effective strategies.'* The enforcement of the therapy was also mentioned by the participants. They argued, *'We have to enforce effective therapies in a gentle and understandable way for our patients because we are the experts.'*

e) Communication in physiotherapy

Most of the information about the patients, their beliefs, and behaviors is provided during the patient interview at the beginning of PT. The physiotherapists named patient encouragement and high levels of communication as methods to influence social support. They stated, *'In my experience, communication can directly affect adherence. It gives you the chance to reduce misunderstandings and learn how to improve yourself.'*

f) Digital tools used by physiotherapists

Regarding digitalization, participants reported having no experience with systems specifically designed for the therapy of LBP, such as smartphone apps. Only videos available on e.g. YouTube were used. However, physiotherapists could all imagine that such programs would promote motivation and long-term adherence to HPs. It would be necessary for the programs to create a social effect through group dynamics, *'There are interesting programs that have a good social effect because they can point users to the adherence of other patients and thus trigger group dynamics no matter where you are. The symbolism, like, graphics show progress and a reward system that illustrates positive progress.'* In addition, the participants clarified that these programs should be free of charge, which otherwise would make it impossible for some patients to use them.

Discussion

This study identified adherence-influencing aspects from the perspectives of patients and physiotherapists. The main requirements of patients were that physiotherapists should provide HP that is individualized,

goal-oriented, and controlled. A main concern was not receiving sufficient PT sessions due to health system requirements in Switzerland and Germany. In these countries, PT sessions are prescript by physicians and every prescription allows for a maximum of six to nine sessions. This was considered relevant for adherence, since insecurity about how to practice exercises correctly, raised the worry of re-injury.

Physiotherapists confirmed some of the aspects raised by the patients. They agreed that time is a limiting factor, and that time-consuming bureaucracy can be a barrier to evidence-based methods, such as pain neurophysiology education and personalized HP. Physiotherapists explained the importance of documentation and writing reports, which is often complicated due to a lack of time. Likewise, a good relationship between therapists and patients with LBP was named as important for adherence by patients and physiotherapists, because it stimulates effective education and individualized therapy approaches.

Previous publications showed factors influencing adherence from the perspective of physiotherapists. They named communication skills and knowledge on how to facilitate behavior change [14–17]. Very similar aspects were identified by the therapists in this current study. A new aspect was that other health professionals might raise false expectations about PT, making education and patient behavior changes unnecessarily complicated. In contrast to the findings from other studies [11,15,16,30,31], the physiotherapists participating in this study were aware of the importance of goal-oriented strategies, such as motivational interviewing, promoting the understanding of the patients, their motivation to exercise, and their adherence to HP.

In line with statements recorded in this study, Palazzo et al. [13] recognized that physiotherapists need to perceive HP as an attractive addition to their treatment and that they need to be supported and not hindered in the development of HP, e.g. by bureaucracy.

While increasing therapy time is partially limited by law, the use of the available time can be shifted toward attractive, patient-centered, meaningful, effective, and easy to perform HP. More time can be allocated to patient education on e.g. pain mechanisms and the subsequent importance of behavior change to promote self-efficacy. This can be enhanced by goal-setting and shared decision-making approaches.

Room et al. [32] found that patient non-adherence to recommended exercises is a challenging aspect of clinical practice. They identified a good patient-therapist relationship as the most important aspect of improving patient adherence. These findings are in line with the results of this present study. Room et al. [32] also detected high levels of frustration among physiotherapists, who often felt powerless to improve patient adherence. They recommended the use of strategies to optimize behavioral changes in patients. In the present

study, methods to induce behavior change were specified and defined as communication and education.

The importance of patient motivation, self-discipline, time, reminders to exercises, difficult or ineffective exercises, patient beliefs, therapist-patient relationship, patient involvement, and patient attitudes were the topic of previous publications and confirmed by the current results [9–13,16]. Additional new aspects were that patient motivation and confidence to perform HP correctly can be influenced by the type of recommendations given by physiotherapists.

The use of digital tools was promoted in previous publications [33–35], but was not specifically highlighted by the results of this current study. Although showing a general interest in the implementation of smartphone apps or other technology, unclear working mechanisms, data protection privacy standpoint, accessibility, costs, and other factors restricted the enthusiasm.

The limitations of this study are that the focus groups were not held face-to-face, as participants chose to be interviewed digitally. This might have reduced the discussion within the groups. The data collection took place in Switzerland and participants were either German or Swiss. While this might reduce the external validity of the data due to the specific healthcare systems in countries, an attempt was made to include a wide range of physiotherapists (e.g. age, clinical approach, education) and patients (e.g. acute, chronic, gender, motivation). However, personal experiences of patients and strategies of physiotherapists will always depend on the selected sample but not all aspects may have been covered by this sample of participants.

Conclusion

LBP patients requested individual, goal-oriented, and long-term care. They expected HP and physiotherapists who take their problems seriously. Physiotherapists treating patients with LBP were interested in developing self-management and active therapy strategies. They reported conflicts with other medical actors, such as general practitioners or colleagues, restricting the implementation of behavioral change strategies for patients with LBP. Physiotherapists described communication, patient education, and attention to patient reports as essential aspects of adherence facilitating physiotherapy. Future research should specify the components for optimized adherence in patients with LBP and focus on the development of outcome measures for adherence.

Acknowledgements

Disclosure statement

Funding

Notes on contributors

Andreas Alt, PhD student, M.Sc., University of Lübeck, Dept. of Health Science

Hannu Luomajoki, Prof. Dr., Zürcher University of applied Sciences, Dept. Physiotherapy

Katharina Röse, Prof. Dr., University of Lübeck, Dept. Health Sciences

Kerstin Lüdtke, Prof. Dr., Senior Lecturer, University of Lübeck, Dept. of Health Science

References

[1] George SZ, Fritz JM, Silfies SP, et al. Interventions for the management of acute and chronic low back pain: revision 2021. J Orthop Sports Phys Ther. 2021;51(11): CPG1–CPG60. doi: 10.2519/jospt.2021.0304

[2] Grabovac I, Dorner TE. Association between low back pain and various everyday performances: activities of daily living, ability to work and sexual function. Wien Klin Wochenschr. 2019;131(21–22):541–549. doi: 10.1007/s00508-019-01542-7

[3] Nkhata LA, Brink Y, Ernstzen D, et al. A systematic review on self-management education campaigns for back pain. S Afr J Physiother. 2019;75(1):1314. doi: 10.4102/sajp.v75i1.1314

[4] Kongsted A, Ris I, Kjaer P, et al. Self-management at the core of back pain care: 10 key points for clinicians. Braz J Phys Ther. 2021;25(4):396–406. doi: 10.1016/j.bjpt.2021.05.002

[5] Chakrabarti S. What's in a name? Compliance, adherence and concordance in chronic psychiatric disorders. WJP. 2014;4(2):30–36. doi: 10.5498/wjp.v4.i2.30

[6] Jack K, McLean SM, Moffett JK, et al. Barriers to treatment adherence in physiotherapy outpatient clinics: a systematic review. Manual Ther. 2010;15(3):220–228. doi: 10.1016/j.math.2009.12.004

[7] Kolt GS, McEvoy JF. Adherence to rehabilitation in patients with low back pain. Manual Ther. 2003;8 (2):110–116. doi: 10.1016/s1356-689x(02)00156-x

[8] Sakthivel V, Krishnasamy V, Mehalingam V. Level of medication adherence and its associated factors among patients receiving antiretroviral therapy at a tertiary care hospital in South India. J Caring Sci. 2020;9(2):93–97. doi: 10.34172/JCS.2020.014

[9] Boutevillain L, Dupeyron A, Rouch C, et al. Facilitators and barriers to physical activity in people with chronic low back pain: a qualitative study. PLoS One. 2017;12 (7):e0179826. doi: 10.1371/journal.pone.0179826

[10] Cherkin D, Balderson B, Brewer G. Evaluation of a risk-stratification strategy to improve primary care for low back pain: the MATCH cluster randomized trial protocol. BMC Musculoskelet Disord. 2016;17(1):361. doi: 10.1186/s12891-016-1219-0

[11] Lonsdale C, Hall AM, Murray A, et al. Communication skills training for practitioners to increase patient adherence to home-based rehabilitation for chronic low back pain: results of a cluster randomized controlled trial. Arch Phys Med Rehabil. 2017;98(9):1732–1743.e7. doi: 10.1016/j.apmr.2017.02.025

[12] Martin LR, Williams SL, Haskard KB, et al. The challenge of patient adherence. Ther Clin Risk Manag. 2005;1 (3):189–199.

[13] Palazzo C, Klinger E, Dorner V, et al. Barriers to home-based exercise program adherence with chronic low back pain: patient expectations regarding new technologies. Ann Phys Rehabil Med. 2016;59 (2):107–113. doi: 10.1016/j.rehab.2016.01.009

[14] Babatunde FO, MacDermid JC, MacIntyre N. A therapist-focused knowledge translation intervention for improving patient adherence in musculoskeletal physiotherapy practice. Arch Physiother. 2017;7(1):1. doi: 10.1186/s40945-016-0029-x

[15] Lemmers G, Bier JD, van Lankveld W, et al. Guideline adherence of physiotherapists in the treatment of patients with low back pain: a qualitative study. J Eval Clin Pract. 2022;28(6):1147–1156. Advanced online publication. doi: 10.1111/jep.13703.

[16] Maas MJ, van Dulmen SA, Sagasser MH, et al. Critical features of peer assessment of clinical performance to enhance adherence to a low back pain guideline for physical therapists: a mixed methods design. BMC Med Educ. 2015;15(1):203. doi: 10.1186/s12909-015-0484-1

[17] Peek K, Carey M, Sanson-Fisher R, et al. Physiotherapists' perceptions of patient adherence to prescribed self-management strategies: a cross-sectional survey of Australian physiotherapists. Disabilit Rehabilitat. 2017;39(19):1932–1938. doi: 10.1080/09638288.2016.1212281

[18] Alt A, Luomajoki H, Lüdtke K. Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy - a two stage systematic review. JBMT. 2023;35:1360–8592. doi: 10.1016/j.jbmt.2023.04.060

[19] Brincks AM, Feaster DJ, Burns MJ, et al. The influence of health locus of control on the patient–provider relationship. Psychol Health Med. 2010;15(6):720–728. doi: 10.1080/13548506.2010.498921

[20] Omeje O, Nebo C. The influence of locus control on adherence to treatment regimen among hypertensive patients. Patient Preference Adherence. 2011;5:141–148. doi: 10.2147/PPA.S15098

[21] Sengul Y, Kara B, Arda MN. The relationship between health locus of control and quality of life in patients with chronic low back pain. Turk Neurosurg. 2010;20 (2):180–185. doi: 10.5137/1019-5149.JTN.2616-09.1

[22] Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349–357. doi: 10.1093/intqhc/mzm042

[23] Pathak V, Jena B, Kalra S. Qualitative research. *Perspect Clin Res*. 2013;4(3):192. doi: 10.4103/2229-3485.115389

[24] Carlsen B, Glenton C. What about N? A methodological study of sample-size reporting in focus group studies. BMC Med Res Methodol. 2011;11(1):26. doi: 10.1186/1471-2288-11-26

[25] Rädiker S, Kuckartz U. Fokusgruppen analysieren. In: Analyse qualitativer daten mit MAXQDA. Springer VS, Wiesbaden; 2019. doi: 10.1007/978-3-658-22095-2

[26] Dresing T, Pehl T. Transkription. In: Mey G Mruck K, editors. Handbuch Qualitative Forschung in der Psychologie. VS Verlag für Sozialwissenschaften; 2010. pp. 723–733. doi: 10.1007/978-3-531-92052-8_50

[27] Kuckartz U. Qualitative text analysis: a guide to methods, practice & Using software. Los Angeles: SAGE Publications Ltd; 2014. doi: 10.4135/9781446288719

[28] Collado-Mateo D, Lavín-Pérez AM, Peñacoba C, et al. Key factors associated with adherence to physical exercise in patients with chronic diseases and older adults: an umbrella review. Int J Environ Res Public Health. 2021;18(4):2023. doi: 10.3390/ijerph18042023

[29] Hayden JA, Wilson MN, Riley RD, et al. Individual recovery expectations and prognosis of outcomes in non-specific low back pain: prognostic factor review. Cochrane Database Syst Rev. 2019;2019(11). CD011284. doi: 10.1002/14651858.CD011284.pub2

[30] Coppack RJ, Kristensen J, Karageorghis CI. Use of a goal setting intervention to increase adherence to low back pain rehabilitation: a randomized controlled trial. Clin Rehabilitat. 2012;26(11):1032–1042. doi: 10.1177/0269215512436613

[31] Taulaniemi A, Kankaanpää M, Rinne M, et al. Fear-avoidance beliefs are associated with exercise adherence: secondary analysis of a randomised controlled trial (RCT) among female healthcare workers with recurrent low back pain. BMC Sports Sci Med Rehabil. 2020;12(1):28. doi: 10.1186/s13102-020-00177-w

[32] Room J, Boulton M, Dawes H, et al. Physiotherapists' perceptions of how patient adherence and non-adherence to recommended exercise for musculoskeletal conditions affects their practice: a qualitative study. Physiotherapy. 2021;113:107–115. doi: 10.1016/j.physio.2021.06.001

[33] Hügli AS, Ernst MJ, Kool J, et al. Adherence to home exercises in non-specific low back pain. A randomised controlled pilot trial. J Bodyw Mov Ther. 2015;19(1):177–185. doi: 10.1016/j.jbmt.2014.11.017

[34] Wälti P, Kool J, Luomajoki H. Short-term effect on pain and function of neurophysiological education and sensorimotor retraining compared to usual physiotherapy in patients with chronic or recurrent non-specific low back pain, a pilot randomized controlled trial. BMC Musculoskelet Disord. 2015;16(1):83. doi: 10.1186/s12891-015-0533-2

[35] Zadro JR, Shirley D, Simic M, et al. Video-game–based exercises for older people with chronic low back pain: a randomized controlledtable trial (GAMEBACK). Phys Ther. 2019;99(1):14–27. doi: 10.1093/ptj/pzy112

Which aspects facilitate the adherence of patients with low back pain to physiotherapy? A Delphi study

Andreas Alt[1], Hannu Luomajoki[2*] and Kerstin Luedtke[1]

Abstract

Background The effectiveness of physiotherapy to reduce low back pain depends on patient adherence to treatment. Facilitators and barriers to patient adherence are multifactorial and include patient and therapist-related factors. This Delphi study aimed to identify an expert consensus on aspects facilitating the adherence of patients with back pain to physiotherapy.

Method International experts were invited to participate in a three-round standard Delphi survey. The survey contained 49 items (32 original and 17 suggested by experts) which were rated on 5-point Likert scales. The items were assigned to six domains. The consensus level was defined as 60%.

Results Of 38 invited experts, 15 followed the invitation and completed all three rounds. A positive consensus was reached on 62% of the 49 proposed items to facilitate adherence. The highest consensus was achieved in the domains "Influence of biopsychosocial factors" (89%) and "Influence of cooperation between physiotherapists and patients" (79%). Additional important domains were the "Influence of competencies of physiotherapists" (71%) and "Interdisciplinary congruence" (78%). "Administration aspects" and the "Use of digital tools" did not reach expert consensus.

Conclusions Biopsychosocial factors, therapeutic skills, and patient-physiotherapist collaboration should be considered in physiotherapy practice to facilitate adherence in patients with LBP. Future studies should prospectively evaluate the effectiveness of individual or combined identified aspects for their influence on patient adherence in longitudinal study designs.

Keywords Low back pain, Physiotherapy, Adherence, Expert consensus

*Correspondence:
Hannu Luomajoki
luom@zhaw.ch
[1]Institute of Health Sciences, Department of Physiotherapy, Universität zu Lübeck, Lübeck, Germany
[2]Institute of physiotherapy, Zürich University of applied Sciences (ZHAW), Katharina-Sulzer-Platz 9, Winterthur CH-8401, Switzerland

Background

According to national and international clinical guidelines, a patient with low back pain (LBP) attending physiotherapy is advised to perform regular physical exercises, avoid prolonged periods of rest, and long-term passive therapy measures such as manual therapy (MT) or massage [1, 34]. The long-term effects of LBP treatment depend on a complex process addressing cognition, function, and pain [10, 11, 14]. This can be achieved by physiotherapy approaches that facilitate patient self-management and require a high level of adherence [10, 11]. Adherence is defined as "the extent to which a person conforms to the agreed-upon recommendations of a health care provider" [30]. The term "adherence" emphasizes the concordant behavior of patient and physician [7] and thereby exceeds compliance, usually defined as "doing what the doctor said" [12]. In physiotherapy, the concept of adherence is multidimensional and based on biopsychosocial influences [2, 16, 18].

Previous research indicates that adherence, often referred to quantitatively as the level of adherence, can be influenced by several factors. These can concern the patient with LBP and be based on his level of motivation, self-discipline, acceptance of specific exercises, perceived effectiveness of the exercises, beliefs, and attitudes, cultural background, and communicative aspects [6, 8, 20–22, 24, 25]. Other factors are more related to the physiotherapist and include communication skills, motivation to enhance the self-efficacy of patients, building a physiotherapist-patient relationship, and professional experience [4, 13, 19, 21].

In a previously conducted focus group study, investigating the perspectives of patients and of physiotherapists, aspects influencing the adherence of patients with LBP were shown to be more complex than expected [3]. Patients requested long-term rehabilitation management, individualized therapy, and effective home programs to achieve a higher level of adherence. Physiotherapists requested more time for patient education. They indicated that adherence to physiotherapy in patients with LBP can be negatively influenced by the advice or expectations induced by other healthcare professionals. Physiotherapists and patients agreed that communication, the quality of the therapist-patient relationship, and

individualized physiotherapy are essential factors facilitating adherence [3]. Following these personal insights into a selection of patients` and therapists` thoughts about adherence, this Delphi study aimed to identify a consensus of experts on adherence-facilitating aspects. The results of the Delphi study are intended to improve the understanding of how to facilitate adherence in patients with LBP to subsequently develop and evaluate targeted treatment strategies.

Methods

A Delphi survey is a consensus method that solicits expert opinion through multiple rounds of questioning. It is characterized by different features: Anonymity, iteration, controlled feedback, and group response [28].

Among the various Delphi methods, the standard Delphi method was used in this study, including three rounds of questionnaires [28]. Data were collected from February 22 to April 01, 2023.

Selection of delphi experts

The technique of purposive sampling was used to select informed individuals to serve on a panel of experts for the Delphi process [23, 31]. The experts were identified through a previously conducted systematic review aiming to identify tools to measure and evaluate the effectiveness of strategies to facilitate adherence in patients with LBP [2]. In addition to inviting the authors of publications included in this review, flyers were posted in physiotherapy groups on social media inviting physiotherapists to the study.

The competence of the experts to contribute to the consensus was based on predefined criteria (Table 1). To include the clinical and the research perspective on adherence, clinicians and researchers were invited to participate.

All identified experts were contacted by e-mail and informed about study procedures and objectives. Those who expressed interest were given an informed consent form to read, sign, and return via e-mail.

Instrument

The first round of the Delphi survey consisted of three steps. First, participants were informed by e-mail how

Table 1 Eligibility criteria

Inclusion criteria	Exclusion criteria
Researchers who have addressed adherence of patients with LBP in scientific articles **OR** At least 3 years of clinical experience in physiotherapy treatment of patients with LBP	Researchers exclusively investigating patient adherence to medication Researchers focusing on patients with psychological disorders
AND Ability to understand English (in writing)	Physiotherapists mainly treating patients with LBP in psychiatric settings

LBP = low back pain

Alt *et al. BMC Musculoskeletal Disorders*   (2023) 24:615
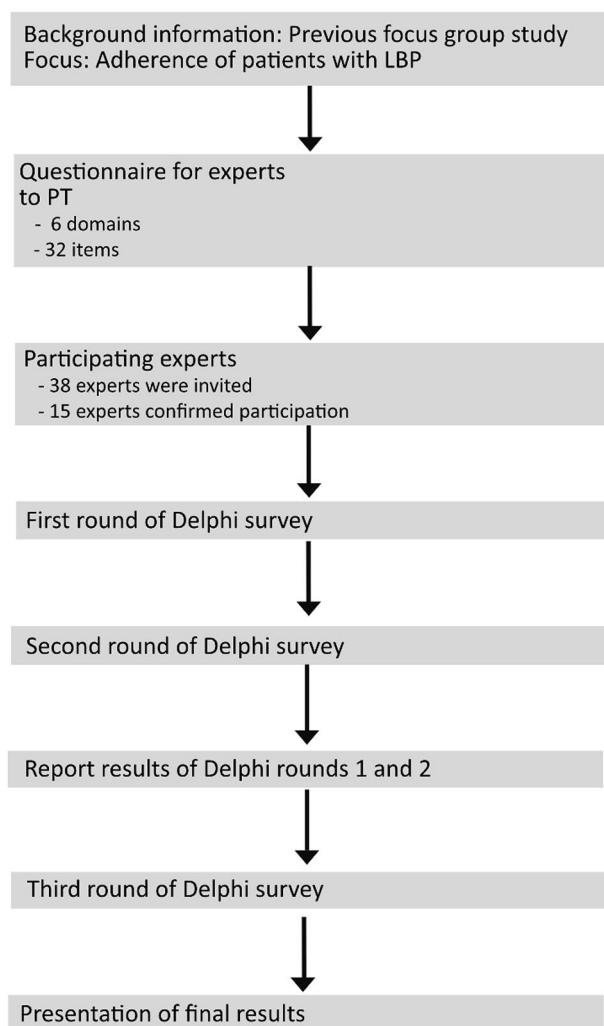
Page 3 of 12

Fig. 1 Methodology
This figure shows the methodological structure of the Delphi study. It includes the preparation and the individual methodological steps

Table 2 Overview of the structure of the Delphi survey related to the first round

Domains		No. of items
1	The influence of the biopsychosocial approach on adherence of patients with LBP to PT	5
2	The influence of cooperation between physiotherapists and patients with LBP on their adherence to PT	6
3	Interdisciplinary congruence in therapeutic strategies influences the adherence of patients with LBP to PT	4
4	The influence of administrative aspects on the adherence of patients with LBP to PT	5
5	The influence of digitization on the adherence of patients with LBP to PT	6
6	The influence of competencies of physiotherapists on adherence of patients with LBP to PT	6
Total number of items 32		

LBP = low back pain; PT = physiotherapy

to complete the survey and how to rate the items. Then, participants received a questionnaire asking about their sociodemographic characteristics (Fig. 1). Finally, experts received the questionnaire with the domains and items related to the adherence of patients with LBP.

The questionnaire was developed based on a previously conducted systematic review [1] and items identified by patients and physiotherapists in a previously conducted focus group study [3]. The questionnaire for the first Delphi round consisted of six domains and 32 associated items potentially influencing adherence to physiotherapy, such as the influence of the biopsychosocial approach, the influence of cooperation between physiotherapists and patients, the influence of digitalization on adherence in patients with LBP (Table 2).

Experts rated the items of each domain on a 5-point Likert scale as absolutely correct [1], correct [2], don't know [3], rather no [4], or wrong [5].

Setting the consensus level
The Delphi method is based on selected participants reaching a consensus on a topic through multiple rounds of discussion. However, the opinions of experts can differ and 100% agreement on all issues is difficult to achieve. There is no recommendation on an appropriate level of agreement and different levels were chosen by previous authors [17, 28]. For this study, an item was excluded from subsequent rounds if more than 60% of the experts rated it as "rather no" or "wrong" (negative consensus). An item was included if 60% or more of the experts rated it as "absolutely correct" or "correct" (positive consensus). Items not reaching this level of agreement due to "don't know" ratings, were presented as "no consensus".

Procedure for the delphi survey
The Delphi survey included three rounds of questionnaires (Fig. 2). In the first round, participants were asked to rate the importance of items that influence the level of adherence of patients with LBP to physiotherapy. They could also name other items which they considered important.

The new items suggested by the experts in round one were included for expert ratings in the second round. In the second round, the experts rated the 17 new items which were also assigned to the six domains.

In the third round, all 15 participants were informed about the results from the first two rounds and asked to review whether they agreed with the results.

Data analysis
The responses from each Delphi round were entered into a Microsoft Excel spreadsheet. To determine the consensus to include, the number of "absolutely correct" and "correct" ratings were counted and presented

First round of Delphi survey
 - Rating the importance of factors influencing adherence quality
 - Rating the items influencing strategies of physiotherapists to facilitate adherence of patients
 - Identification of items to be changed (added or omitted)

Second round of Delphi survey
 - Rating the importance of factors influencing adherence quality
 - Rating the importance of factors influencing physiotherapists' strategies to facilitate patients' adherence

Third round of Delphi survey
 - Informing the experts about results from the first two rounds
 - Clarification of the results

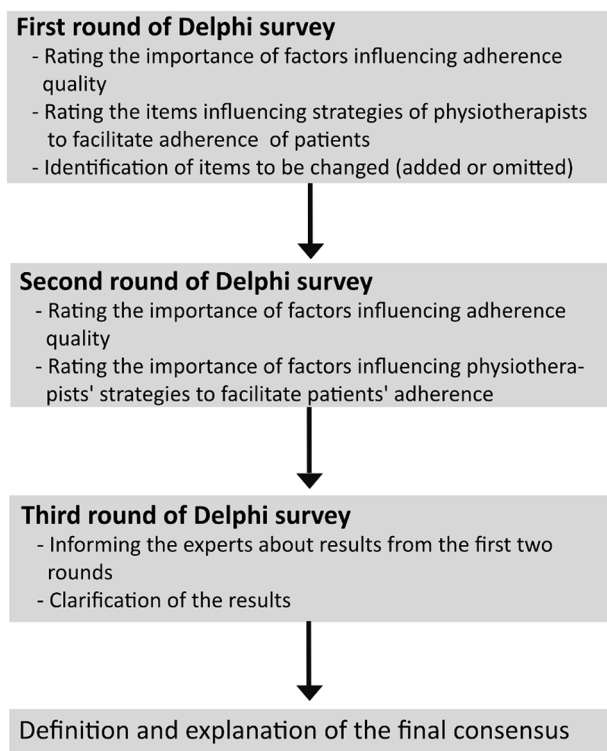Definition and explanation of the final consensus

Fig. 2 Delphi process
This figure shows the contents of the individual Delphi rounds and their sequence

as a percentage of all ratings. In addition, open questions were asked in the first round for each dimension, which the experts could optionally answer. The answers of the experts to the open questions were converted into new items and presented to experts to be rated in the second round.

Results
Out of 38 contacted experts, 15 agreed to participate in the Delphi survey. The experts were contacted via e-mail. 18 of the experts did not respond and five indicated they did not feel eligible. Participating experts came from six different countries, three continents, seven universities, eight physiotherapy centers, and had various professional positions (Table 3). The response rate in rounds one and two was 100% (n=15). A positive consensus was reached on 62% of the 49 proposed items.

Expert consensus for all domains
Domain one The influence of the biopsychosocial approach on adherence of patients with LBP to physiotherapy.
Most experts (n=13) indicated that applying a biopsychosocial approach influences adherence of patients with LBP and only two rated "don't know". All items in this domain in round one reached a high consensus to include

(97%). For round two, four new items were suggested by experts for this domain, which all reached consensuses to include (Table 4).

Domain two The influence of cooperation between physiotherapists and patients with LBP on their adherence to physiotherapy.
Most experts (n=11) indicated with a consensus of 79% that the cooperation between physiotherapists and patients with LBP influences adherence. Three experts rated with "don't know". In round one, all items achieved a consensus to include except item "Opportunities of rating the PT quality". Four new items were suggested by experts during round one and three of these were included according to the ratings from round two. Ratings for the item "Opportunities of rating the physiotherapy quality" had a high level of uncertainty (eight out of 15 experts rated "don't know") (Table 5).

Domain three Interdisciplinary congruence on therapeutic strategies influences adherence to physiotherapy of patients with LBP.
Most experts (n=13) indicated that the influence of interdisciplinary congruence in terms of therapeutic strategies influences the adherence of patients with LBP. The highest consensuses to include in round one was achieved by the item "Therapeutic agreement" (100%). Two new items were suggested by experts during round one, both reaching consensus to include (Table 6).

Domain four The influence of administrative burdens on the adherence of patients with LBP to physiotherapy.
Responses for the five initial and two newly suggested items in this domain were controversial and consensus (to exclude) was reached for all items in the domain (Table 7).

Domain five The influence of digital tools in relation to physiotherapy on adherence of patients with LBP.
Ten experts stated that digital tools, e.g., the use of apps, influences the adherence of patients with LBP to physiotherapy. One expert did not rate items two and five. The consensus was reached that "Digital-based therapy (DBT) must be individualized" (93%) and for the use of graphs and trends. Two additional items were suggested in round one. These suggested that digital tools need to be manageable and that online recommendations can facilitate adherence. Both reached consensuses to include (Table 8).

Domain six The influence of competencies of physiotherapists on adherence of patients with LBP.
Most of the experts (n=13) stated that the competence of physiotherapists influences the adherence of patients

Table 3 Characteristics of experts

ID	Gender	Age (years)	AD	Country	Position	Specialization	PE (years)	Clinic. exp. with LBP	Scien. exp. with LBP	Prof. courses
E1	m	56	B.Sc.	GER	Employee	M.Sc. of NS	37	Yes	No	MI
E2	f	39	PhD	FIN	Lecturer, development expert	Research, teaching	16	Yes	Yes	MI, VC, IS
E3	f	30	M.Sc.	GER	Research associate, employee	Research, clinical practice	8	Yes	Yes	X
E4	m	29	Dipl.	GER	Employee, lecturer	Teaching, clinical practice	9	Yes	No	MI, CFT
E5	m	25	B.Sc.	CH	Employee	Clinical practice	4	Yes	No	MI
E6	m	36	M.Sc.	CH	Head of master programs	Research, lecturer	12	Yes	Yes	MI, PCC
E7	m	38	Dipl.	GER	Employee	Clinical practice	17	Yes	No	CFT
E8	m	56	Dipl.	GER	Management	LS, teaching, clinical practice, research	31	Yes	Yes	MI
E9	m	25	B.Sc.	GER	Employee	Teaching, clinical practice	3	Yes	No	MI
E10	m	50	M.Sc.	NL	Employer	IS, clinical practice	25	Yes	No	EP, MI, SPT
E11	f	46	Ph.D.	ZMB	Lecturer	Research, teaching	12	Yes	Yes	VC, LS, GPTR
E12	f	53	Ph.D.	USA	Lecturer	Research, teaching	27	No	Yes	CPS, HP
E13	f	34	Ph.D.	GER	Research associate	Research, teaching	10	Yes	Yes	X
E14	f	26	B.Sc.	GER	Employee	Clinical practice	5	Yes	No	MI, PCC
E15	f	46	Ph.D.	CH	Researcher	Research	12	Yes	Yes	X

AD=academic degree; B.Sc. = bachelor of science; CFT=cognitive functional therapy; CH=Switzerland; clinic. exp. = clinical experience; CPC=clinician-Patient Communication; EP=explain pain; f=female; FIN=Finland; GER=Germany; HP=Health Psychology; ID=identification of participant (coded); GPTR=gynecologic physiotherapy rehabilitation; IS=implementation science; LBP=low back pain; MI=motivational interviewing, m=male; M.Sc.=master of science; NL=Netherlands; PCC=patient centered communication; NS=neuroscience; PE=professional experience; Ph.D. = doctoral degree; scien. exp. = scientific experience; SPT=sports physiotherapy; USA=United States of America; VC=validating communication; ZMB=Zambia;

with LBP to physiotherapy. One expert did not rate the item "Offering sufficient HP". All six proposed items on physiotherapist-related aspects reached a consensus to include. The two new proposed items on the reputation of physiotherapists and regular supervision by other physiotherapists were not included in the consensus due to a high number of "don't know" ratings (Table 9).

In the third and final round, the experts were informed about the results from the first two rounds. They were asked whether they agreed with the summary of responses and to comment on the results. No adjustments were required from round three.

Discussion

The purpose of this Delphi study was to reach an expert consensus on aspects to include when aiming to facilitate adherence to physiotherapy in patients with low back pain. Six domains were developed containing six to ten items (total of 49 items) of which 17 were contributed by experts during round one. The highest consensus (100%) was reached for items within the domains one, two, three, and six. This indicated that the influence of interprofessional collaboration (four items at 100% consensus), a

biopsychosocial approach, and the competencies of physiotherapists (three items at 100% consensus each), as well as the patient-therapist relationship, were regarded as the most relevant factors influencing patient adherence.

The high consensus reached for all items describing a positive patient-therapist relationship, is in line with findings from qualitative studies. These reported that the relationship between the patient and the healthcare provider, e.g., the physiotherapist is of high importance [3, 6, 22, 26]. Participation, commitment, negotiation, and sometimes compromise improve the responsibility of the patient and thus the basis for adherence [22].

The relevance of interdisciplinary congruence, mentioned in domain three, was also identified in our previously conducted focus group study. Physiotherapists argued that the advice and information provided by other healthcare providers, influenced the expectations of patients and thereby their adherence (positively or negatively) [3].

Indications for the importance of this aspect have been reported in other qualitative studies [19, 21]. Studies using quantitative approaches postulated the use of communication strategies, individualized patient-centered

Table 4 Consensus for domain one "The influence of the biopsychosocial approach on adherence of patients with LBP to physiotherapy"

The influence of the biopsychosocial approach on the adherence of patients with LBP to physiotherapy							
Ratings of experts round 1							
Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
1	**Acceptance of therapy program**	9	6				100	
2	**Explanation of therapy programs**	8	7				100	
3	Motivation of patients with LBP	12	2	1			93	
4	**Expectations of patients with**	13	2				100	
5	Beliefs of patients with LBP	13	1	1			93	
Positive consensus round 1 (mean)		97						
Ratings of experts for newly suggested item in round 2							
Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
6	Understanding about a realistic course of treatment	12	1	1	1		87	
7	Health literacy of patients with LBP	8	6	1			93	
8	Safe surroundings in PT session	7	6	2			87	
9	ILC of patients	8	3	4			73	
10	Cultural situation of patients with LBP	1	9	4	1		67	
Number of experts (mean)		9	4	2	2			
Median of both rounds		8.5	4.5	1	1			
Positive consensus of round 2 (mean)		81						
Positive consensus both rounds (mean)		89						

LBP = low back pain; ILC = internal locus of control; PT = physiotherapy

physiotherapy, and knowledge of the evidence for treatment options [9, 20]. Communication as a method to influence adherence was also researched in the RCT by Londsdale et al. (2017) [20]. They found that communication skills of physiotherapists had short-term positive effects on self-reported home-based adherence of patients (weeks 1–12) but not on other adherence factors, e.g., adherence to back exercises. Coppack et al. (2012) showed in their RCT that the level of adherence in the group with goal-setting (group 1) was significantly higher than in the two comparison groups (group 2 = standard exercise program with motivation; group 3 = standard exercise program with monitoring of exercise technique for safety) [9]. But they did not present information about the specific reason for the superior results of the group with goal-setting.

Less information was available for aspects related to "digitalization" [29, 32], "administrative burdens" [15], and their influence on adherence. This could explain the relatively high number of "don't know" ratings. Simple methods of DBT, such as the use of video games that promote activity, have been shown by the existing literature to effectively influence adherence in patients with LBP [29, 31]. In this current sample of experts, there was agreement that digital tools need to be individualized [5, 26], easy to manage, and should provide graphics and trends to increase motivation. Online recommendations were also regarded to facilitate adherence. Zhang et al. (2019) reported that media campaigns can influence patient health information seeking and that health information seeking can influence patient adherence [33]. There is currently no additional evidence for a relationship between adherence and online health information.

Whether administration aspects influence adherence was perceived controversially. While a burden to patients and therapists it may not have an influence on adherence to physiotherapy. Herd et al. (2021) noted that administrative burden depends on many factors, such as access

Alt *et al. BMC Musculoskeletal Disorders*   (2023) 24:615

Page 7 of 12

Table 5 Consensus on domain two "The influence of cooperation between physiotherapists and patients with LBP on their adherence to physiotherapy"

The influence of cooperation between physiotherapists and patients with LBP on their adherence to physiotherapy

Ratings of experts round 1

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	In-	Excluded cons. (%)
1	**Trust of patients with LBP**	15						
2	Patient-physio-therapist sympathy	5	7	3				80
3	**Taking patients with LBP seriously**	14	1					
4	**Including the views of patients with LBP**	12	3					
5	Providing long-term updates	10	4	1				80
6	**Verbal communication**	11	4					
Positive consensus round 1 (mean)		93						

Ratings of experts for newly suggested items in round 2

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	In-	Excluded cons. (%)
1	Positively coined cues (verbal and non-verbal)	11	3	1				93
2	Cultural factors influence adherence	1	10	4				73
3	Understanding of morality by physiotherapists	3	11	1				93
4	Opportunities of rating the PT quality	2	2	8	2	1		73
Number of experts (mean)		8	5	3	2	1		
Median of both rounds		11	4	2				
Positive consensus round 2 (mean)		65						
Positive consensus both rounds (mean)		79						

LBP = low back pain; PT = physiotherapy

to healthcare, appointment management, and costs. For patients with chronic conditions, these factors might accumulate to a burden influencing adherence to physiotherapy. In contrast to the findings from our focus group study, the experts did not recognize self-paying of patients with LBP for physiotherapy as an aspect influencing adherence [3].

This Delphi study provides expert consensus on aspects that facilitate the adherence of patients with LBP to physiotherapy. Future research has to evaluate in prospective longitudinal study designs whether individual aspects or combinations of these are the most effective to facilitate adherence to physiotherapy.

Limitations

The suggestions emerging from this Delphi survey are based on a small number of experts. The experts came from six different countries and three continents (North America, Africa, and Europe). However, they do not represent the general population of physiotherapists. The study cannot provide evidence for the effectiveness of one or more of the proposed strategies.

Conclusion

Biopsychosocial aspects, implemented into physiotherapy treatment, but also the competencies of physiotherapists, interprofessional congruence, and the patient-therapist relationship were seen as important aspects to influence adherence. The use of digital tools could facilitate adherence if designed to meet the

Table 6 Consensus on domain three "Interdisciplinary congruence on therapeutic strategies influences adherence to physiotherapy of patients with LBP"

Interdisciplinary congruence in therapeutic strategies influences adherence of patients with LBP to physiotherapy

Ratings of experts round 1

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	In-	Ex-cluded cons. (%)
1	**Therapeutic agree-ment**	11	3		1			
2	Physician and therapist agreement	8	2	2	3			67
3	**Regular professional exchange**	8	4	2	1			80
4	Mutual professional respect	8	3	4				73
Positive consensus round 1 (mean)		80						

Ratings of experts for newly suggested items in round 2

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	In-	In-cluded cons. (%)
1	Constant presence of respect towards colleagues	6	5	4				73
2	**Similar evidence-based knowledge**	6	6	3				80
Number of experts (mean)		9	4	3	2			
Median of both rounds		8	4	3	1			
Positive consensus round 2 (mean)		77						
Positive consensus both rounds (mean)		78						

LBP = low back pain

individual needs of patients. Whether administrative aspects influence adherence is unclear. Longitudinal studies evaluating the effect of using the identified items are required to assess whether patient adherence can be influenced using these strategies and which strategy results in the best outcomes.

Table 7 Consensus on domain four "The influence of administrative burdens on adherence of patients with LBP to physiotherapy"

The influence of administrative burdens on the adherence of patients with LBP to physiotherapy

Ratings of experts round 1

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
1	The longer the wait for a PT appointment	2	2	5	5	1		73
2	Management of payers	3	3	5	4			60
3	Self-paying and adherence quality	1	1	3	5	5		87
4	Adherence to legally mandated timelines	2	4	6	3			60
5	Legally established procedures	3	2	5	3	2		67
Positive consensus round 1 (mean)								

Ratings of experts for newly suggested items in round 2

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded. cons. (%)
6	Issuance of bills due to missed appointments affects adherence	1	3	6	5			73
7	Expensive PT influences adherence	4	4	6		1		47
Number of experts (mean)		2	3	5	4	2		
Median of both rounds		2	3	5	5	2		
Positive consensus round 2 (mean)								
Positive consensus both rounds (mean)								

LBP = low back pain; PT = physiotherapy

Table 8 Consensus on domain five "The influence of digitization on adherence of patients with LBP"

The influence of digitization on adherence of patients with LBP to physiotherapy

Ratings of experts round 1

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
1	Patients have no experience DBT		2	7	3	3		87
2	Privacy is not important to most patients		2	5	4	3		87
3	**DBT must be individualized**	8	6	1			93	
4	DBT variability promotes adherence	2	5	6	2			53
5	Graphs and trends improve adherence	6	6	1	1		80	
6	Adherence is higher to human-based PT than to DBT	4	4	4	2	1		47
Positive consensus round 1 (mean)		27						
Ratings of experts for newly suggested items in round 2								
Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
7	**The manageability of DBT improves adherence**	8	6	1			93	
8	Online recommendations improve adherence	3	9	2			80	
Number of experts (mean)		5	5	3	2	2		
Median of both rounds		5	6	3	2	3		
Positive consensus round 2 (mean)		87						
Positive consensus both rounds (mean)		57						

Cons=consensus; DBT=digital-based therapy; LBP=low back pain; PT=physiotherapy

Alt *et al. BMC Musculoskeletal Disorders*   (2023) 24:615

Page 11 of 12

Table 9 Consensus on domain six "The influence of competencies of physiotherapists on adherence of patients with LBP"

The influence of competencies of physiotherapists on adherence of patients with LBP to physiotherapy

Ratings of experts round 1

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
1	Motivation of physio-therapists	11	2	1	1		87	
2	**Good knowledge or courses**	12	3				100	
3	**Communication skills**	14	1				100	
4	**Individual patient-oriented PT strategy**	13	2				100	
5	Offering sufficient HP	7	6		1		87	
6	Authenticity of physio-therapists	7	7	1			93	
Positive consensus round 1 (mean)		98						

Ratings of experts for newly suggested items in round 2

Item		Absolutely correct	Correct	Don't know	Rather no	Wrong	Included cons. (%)	Excluded cons. (%)
7	Regular supervision of physiotherapists by other physiotherapists	5	3	5	2			47
8	Reputation of therapist	2	2	8	2	1		73
Number of experts (mean)		9	4	4	2	1		
Median of all rounds		9	3	3	2			
Positive consensus of round 2 (mean)		71						
Positive consensus in both rounds (mean)		71						

Cons. = consensus; LBP = low back pain; pos. = positive; PT = physiotherapy

Declarations

Ethics approval and consent to participate
This study was approved by the Ethics Committee of the University of Lübeck (registration number: 2023 – 192) and its protocol has been registered on Open Science Framework: https://osf.io/ehx4f/. All methods were carried out in accordance with the relevant guidelines and regulations. Informed consent was obtained from all subjects regarding the study procedure and the study itself.

Consent for publication
This study does not contain data of individuals, such as personal data, images or videos.

Competing interests
The authors declare that they have no competing interests.

References
1. Arzneimittelkommission der deutschen Ärzteschaft, Bundespsychotherapeutenkammer, Bundesverband selbstständiger Physiotherapeuten, Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin, Deutsche Gesellschaft für Anästhesiologie und Intensivmedizin, Deutsche Gesellschaft für Arbeitsmedizin und Umweltmedizin. Nationale VersorgungsLeitlinie Nicht-spezifischer Kreuzschmerz – Kurzfassung, 2. Auflage. Bundesärztekammer (BÄK); Kassenärztliche Bundesvereinigung (KBV); Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften (AWMF); 2017.
2. Alt A, Luomajoki H, Luedtke K. Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy - A two-stage systematic review. J Bodyw Mov Ther. 2023;35:208–19.
3. Alt A, Luomajoki H, Luedtke K. How do non-specific back pain patients think about their adherence to physiotherapy and what influences the strategies used by physiotherapists to facilitate adherence? " under review; 2023.

4. Babatunde FO, MacDermid JC, MacIntyre N. A therapist-focused knowledge translation intervention for improving patient adherence in musculoskeletal physiotherapy practice. Arch Physiother. 2017;7:1.

5. Bastemeijer CM, van Ewijk JP, Hazelzet JA, Voogt LP. Patient values in physiotherapy practice, a qualitative study. Physiother Res Int. 2021;26(1):e1877.

6. Boutevillain L, Dupeyron A, Rouch C, Richard E, Coudeyre E. Facilitators and barriers to physical activity in people with chronic low back pain: a qualitative study. PLoS ONE. 2017;12(7):e0179826.

7. Chakrabarti S. What's in a name? Compliance, adherence and concordance in chronic psychiatric disorders. World J Psychiatry. 2014;4(2):30–6.

8. Cherkin D, Balderson B, Brewer G, Cook A, Estlin KT, Evers SC, et al. Evaluation of a risk-stratification strategy to improve primary care for low back pain: the MATCH cluster randomized trial protocol. BMC Musculoskelet Disord. 2016;17(1):361.

9. Coppack RJ, Kristensen J, Karageorghis CI. Use of a goal setting intervention to increase adherence to low back pain rehabilitation: a randomized controlled trial. Clin Rehabil. 2012;26(11):1032–42.

10. George SZ, Fritz JM, Silfies SP, Schneider MJ, Beneciuk JM, Lentz TA, et al. Interventions for the management of Acute and Chronic Low Back Pain: Revision 2021. J Orthop Sports Phys Ther. 2021;51(11):CPG1–CPG60.

11. Grabovac I, Dorner TE. Association between low back pain and various everyday performances: activities of daily living, ability to work and sexual function. Wien Klin Wochenschr. 2019;131(21–22):541–9.

12. Gray R, Wykes T, Gournay K. From compliance to concordance: a review of the literature on interventions to enhance compliance with antipsychotic medication. J Psychiatr Ment Health Nurs. 2002;9(3):277–84.

13. Hall AM, Ferreira PH, Maher CG, Latimer J, Ferreira ML. The influence of the therapist-patient relationship on treatment outcome in physical rehabilitation: a systematic review. Phys Ther. 2010;90(8):1099–110.

14. Hayden JA, Wilson MN, Riley RD, Iles R, Pincus T, Ogilvie R. Individual recovery expectations and prognosis of outcomes in non-specific low back pain: prognostic factor review. Cochrane Database Syst Rev 2019; 2019(11).

15. Herd P, Moynihan D. Health care administrative burdens: centering patient experiences. Health Serv Res. 2021;56(5):751–4.

16. Jack K, McLean SM, Moffett JK, Gardiner E. Barriers to treatment adherence in physiotherapy outpatient clinics: a systematic review. Man Ther. 2010;15(3):220–8.

17. Keeney S, Hasson F, McKenna H. Consulting the oracle: ten lessons from using the Delphi technique in nursing research. J Adv Nurs. 2006;53(2):205–12.

18. Kolt GS, McEvoy JF. Adherence to rehabilitation in patients with low back pain. Man Ther. 2003;8(2):110–6.

19. Lemmers GPG, Bier JD, van Lankveld W, Westert GP, Staal JB, van der Wees PJ. Guideline adherence of physiotherapists in the treatment of patients with low back pain: a qualitative study. J Eval Clin Pract. 2022;28(6):1147–56.

20. Lonsdale C, Hall AM, Murray A, Williams GC, McDonough SM, Ntoumanis N, et al. Communication skills training for practitioners to increase patient adherence to Home-Based Rehabilitation for Chronic Low Back Pain: results of a Cluster Randomized Controlled Trial. Arch Phys Med Rehabil. 2017;98(9):1732–1743e7.

21. Maas MJM, van Dulmen SA, Sagasser MH, Heerkens YF, van der Vleuten CPM, Nijhuis-van der Sanden MWG, et al. Critical features of peer assessment of

22. clinical performance to enhance adherence to a low back pain guideline for physical therapists: a mixed methods design. BMC Med Educ. 2015;15:203.

22. Martin LR, Williams SL, Haskard KB, Dimatteo MR. The challenge of patient adherence. Ther Clin Risk Manag. 2005;1(3):189–99.

23. Maxwell J. Designing a qualitative study. In handbook of applied social research methods. Sage 1997: 69–100.

24. McLean S, Holden MA, Potia T, Gee M, Mallett R, Bhanbhro S, Parsons H, Haywood K. Quality and acceptability of measures of exercise adherence in musculoskeletal settings: a systematic review. Rheumatology (Oxford). 2017;56(3):426–38.

25. Palazzo C, Klinger E, Dorner V, Kadri A, Thierry O, Boumenir Y, et al. Barriers to home-based exercise program adherence with chronic low back pain: patient expectations regarding new technologies. Ann Phys Rehabil Med. 2016;59(2):107–13.

26. Room J, Boulton M, Dawes H, Archer K, Barker K. Physiotherapists' perceptions of how patient adherence and non-adherence to recommended exercise for musculoskeletal conditions affects their practice: a qualitative study. Physiotherapy. 2021;113:107–15.

27. Taulaniemi A, Kankaanpää M, Rinne M, Tokola K, Parkkari J, Suni JH. Fear-avoidance beliefs are associated with exercise adherence: secondary analysis of a randomised controlled trial (RCT) among female healthcare workers with recurrent low back pain. BMC Sports Sci Med Rehabil. 2020;12:28.

28. Walker AM, Selfe J. The Delphi method: a useful tool for the allied health researcher. Br J Therapy Rehabilitation. 1996;3(12):677–81.

29. Wälti P, Kool J, Luomajoki H. Short-term effect on pain and function of neurophysiological education and sensorimotor retraining compared to usual physiotherapy in patients with chronic or recurrent non-specific low back pain, a pilot randomized controlled trial. BMC Musculoskelet Disord. 2015;16:83.

30. WHO. World Health Organisation. Adherence to Long Term Therapies – Evidence for Action. WHO Library Cataloguing-in-Publication Data. 2003.

31. Williams PL, Webb C. The Delphi technique: a methodological discussion. J Adv Nurs. 1994;19(1):180–6.

32. Zadro JR, Shirley D, Simic M, Mousavi SJ, Ceprnja D, Maka K, et al. Video-Game-Based exercises for older people with chronic low back Pain: a Randomized Controlledtable Trial (GAMEBACK). Phys Ther. 2019;99(1):14–27.

33. Zhang R, Lu X, Wu W, Shang X. Why do patients follow physicians' advice? The influence of patients' regulatory focus on adherence: an empirical study in China. BMC Health Serv Res. 2019;19(1):301.

34. Oliveira CB, Maher CG, Pinto RZ, et al. Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. Eur Spine J. 2018;27(11):2791–803. https://doi.org/10.1007/s00586-018-5673-2.

Publisher's Note

9. Acknowledgements

First, I would like to thank all participants who took part in the studies of my Ph.D. Without these people, such research projects would not be possible.

Furthermore, I would like to thank my second supervisor Prof. Dr. Hannu Luomajoki, who supported me for a long time in different ways when I needed support and whose recommendation made it possible for me to start the Ph.D.

My special thanks go to my first supervisor Prof. Dr. Kerstin Lüdtke, who perceived me as an individual, recognized my strengths, supervised me perfectly, and always gave me the feeling of not failing. Through her influence, I reached a new level of my performance quality.

Finally, I would like to thank my father, who unfortunately passed away much too early in my life. He shaped my behavior with the words, *"Use your potential and never give up!"* These words guide me to this day and hopefully forever.

10. Curriculum Vitae

Personal details

Name and titel	Andreas Alt, M.Sc.
Residential	XXXXXstrasse 8, CH-XX53 XXX
Phone	+4176XX35XX0
E-Mail	andreas-alt@gmx.de
Nationality	Germany
Date of birth	November 4, 1987
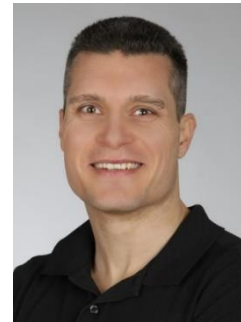
Work experience

Oct. 2021 - today
Ph.D. student
Institut für Gesundheitswissenschaften, Dept. of Physiotherapy
Research: Adherence of patients with LBP to physiotherapy

Sep. 2020 - today
SportClinic Sihlcity, Zürich, CH
QM-Management - Dept. of Physiotherapy and physiotherapist
Main focus: Interdisciplinary information exchange, supervision of employees, professional related presentations, clinical physiotherapy

Sep. 2018 – Sep. 2020
Fit 4 Life AG, Siggenthal Station, CH
Manager department of physiotherapy, physiotherapist
Main focus: inter- and multidisciplinary networking, development of PR strategies to support evidence-based therapy approaches to patients and health care providers, supervision of interns, administration

Aug. 2017 – Sep. 2018
Fit 4 Life AG, Siggenthal Station, CH
Physiotherapist
Main focus: individual and group therapies based on evidence-based (biopsychosocial approach)

May 2016 – Aug. 2017	**Physio & Sport, Baden, CH** Physiotherapist <u>Main focus:</u> physiotherapeutic care of athletes from endurance sports, biopsychosocial pain therapy for acute and chronic complaints, medical training therapy
June 2015 – May 2016	**Reha am Stadtpark, Fürth, GER** Physiotherapist <u>Main focus:</u> Physiotherapeutic care of athletes from the German Handball Bundesliga
April 2014 – June 2015	**Physiotherapie Schulz, Nürnberg, GER** Physiotherapist and student (M.Sc.) <u>Main focus:</u> Therapy of musculoskeletal complaints
May 2010 – April 2014	**Physiotherapie U. Jakob, Fürth, GER** Physiotherapist (Dipl.) and student (B.Sc.)

Studies

Oct. 2021 – today	**University of Lübeck** (UzL), GER Ph.D. student Research: Adherence to physiotherapy for non-specific back pain
March 2013 – May 2015	**Deutsche Sporthochschule Köln** (DSHS), GER Study M.Sc. Sports Physiotherapy
March 2010 – Dec. 2012	**Hoogeschool Thim van der Laan**, Utrecht, NL Study B.Sc. Physiotherapy
Sep. 2007 – Sep. 2010	**Staatlich anerkannte Berufsfachschule für Physiotherapie Nürnberg**, GER Fachschulausbildung Physiotherapy

Publications

<u>The following three publications with titles in bold are part of this cumulative dissertation:</u>

Alt, A., Luomajoki, H., Roese, K., & Luedtke, K. (2023). **How do non-specific back pain patients think about their adherence to physiotherapy, and what strategies do physiotherapists use to facilitate adherence? A focus group interview study.** *The Journal of manual & manipulative therapy*, 1–9. Advance online publication. https://doi.org/10.1080/10669817.2023.2258699

Alt, A., Luomajoki, H., & Luedtke, K. (2023). **Which aspects facilitate the adherence of patients with low back pain to physiotherapy? A Delphi study**. BMC musculoskeletal disorders, 24(1), 615. https://doi.org/10.1186/s12891-023-06724-z

Alt, A., Luomajoki, H., Lüdtke, K. (2023). **Strategies to facilitate and tools to measure non-specific low back pain patients' adherence to physiotherapy - A two-stage systematic review**. *Journal of Bodywork and Movement Therapies.* https://doi.org/10.1016/j.jbmt.2023.04.060

Kolster, B.C., Gesing., V., Winkelmann., C., Alt., A. (2023). Handbuch für Physiotherapie – umfassend, aktuell, evidenzbasiert, praxisnah, 2. Auflage. KVM – der Medizinverlag

Alt., A. Die Physiotherapie und ihre Zukunft – was kommt nach der Akademisierung? Seminar (2 Unterrichts-einheiten/Fortbildungspunkte): *Therapiemesse München*, 29. November, 10:30 – 12:00 Uhr, Saal 4a

Alt, A., Herbst, M., Reis, J. (2022). Physiotherapie Grundlagen (Best Practice), 3. Auflage. Amazon & Books. ISBN: 979-8816963428

Alt, A., Fassian, N. (2022). Modelle und Theorien für das Schmerzmanagement - die wichtigsten Meilensteine der letzten Jahrzehnte. pt-2022-05. S. 22 - 26.

Alt, A., Herbst, M. (2022). Sportphysiotherapie und Athletiktraining – Rehabilitation, Diagnostik und Entwicklung. Amazon & Books

Alt, A., Fassian N. (2022). Evidenzbasierte Leitlinien in der deutschen Physiotherapie. pt-2022-01. S. 18 - 21.

Alt, A., Fassian, N. (2021). Usability of the "Mature Organism Model" in comparison to other models - Critical Appraisal. Posterpresentation. Conference: *Internationales Forschungssymposium für Physiotherapie (FSPT 2021),* Session 4, 21st of Novemeber 2021,12:20. Moderation: Prof. Dr. Sven Karstens

Alt, A., Fassian, N. (2021). Digitalisierung der Physiotherapie schreitet voran. *pt Zeitschrift*. 11, 73: S. 10 - 13

Alt, A. (2021). Was kann die Physiotherapie zum Umweltschutz beitragen? *pt Zeitschrift* 9, 73: 14 - 17

Alt, A., Sommer, M. (2021). Evidenzbasierte Physiotherapie verstehen. Die Fachwelt, Oktober 2021

Alt, A., Kolster B.C. (2021). Du bist dein eigener Therapeut – Rückenschmerzen. KVM – Der Medizinverlag

Alt, A., Mötteli, C. (2021). Effektive Therapie von Rückenschmerzen - Das nationale dänische Versorgungs-konzept GLA:D Back. *pt Zeitschrift* 8, 73: 32 – 34

Alt, A. (2021). Wie viel Zeit braucht der Akademisierungsprozess? In Deutschland fehlen Einigkeit und Motivation. *pt Zeitschrift*, 5: 16 - 17

Alt, A., van der Weijden, F. (2020). Die Ökonomie der evidenzbasierten Physiotherapie – ein neuer Weg. Amazon Books

Alt, A., Zwerenz, A. (2020). Die Kritik an der Physiotherapie – eine wahre Chance. München, Amazon Books

Alt, A., Malcherek, N., Geisler, S., Thietje, R. (2020). The sustainable effectiveness to avoid chronification in non-specific, non-chronic back pain. *German Journal of Sports Medicine*. 71: 97 – 103, DOI: 10.5960/dzsm. 2020.425

Alt, A., Bartkowski, N. (2020). Psychosoziale Therapie bei Extremverletzungen. *pt Zeitschrift*, 72: 40 – 43

Alt, A., Malcherek, N., (2020). Nachhaltige Physiotherapie bei unspezifischen Rückenschmerzen. *pt Zeitschrift*, 72: 34 – 36

Hoffmann, H., Alt, A. (2019). Spannungsfelder in der Physiotherapie - Wie kann professionelles Arbeiten gelingen? *pt Zeitschrift*, 71: 33 – 36

Alt, A., Malcherek, N., Geisler, S., Thietje, R. (2019). Poster presentation: The cost and efficiency of progressive exercise therapy compared to passive therapy for nonspecific back pain. *Forschungssymposium (DGPTW)*, Nov. 23, 13:00, Hildesheim, DEU

Alt, A., Herbst, M., Reis, J. Physiotherapie Grundlagen (Best Practice), 2. Auflage (2028). München, Amazon Books

Alt, A., Herbst M. (2017). Rehabilitation, Leistungsdiagnostik und Entwicklung von Athleten. München, Amazon Books

Alt, A., Herbst, M. Physiotherapie Grundlagen (Best Practice) (2016). München. Amazon Books

Geisler, S., Alt, A., Kreutz, T. (2016). Poster presentation: Comparison of high and low volume Eccentric Resistance Training in patients with jumper´s knee. *American College of Sports Medicine*, 1631 Board #284 June 2, 8: 00 AM - 9: 30 AM, Indianapolis, USA