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Application of Disease-Specific Knowledge in the Rehabilitation Process – Based on the Effects of Back School Program among Chinese Adults

Ph.D. Dissertation

Zhe Wang

University of Pécs

Faculty of Health Sciences

Doctoral School of Health Sciences

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UNIVERSITY OF PÉCS

FACULTY OF HEALTH SCIENCES

DOCTORAL SCHOOL OF HEALTH SCIENCES

Head of Doctoral School: Prof. Dr. István KISS

Programme Leader: Prof. Dr. Rétsági Erzsébet

Programme Co-Leader: Prof. Dr. Ács Pongrác

Supervisor: Dr. Járomi Melinda

Co-Supervisor: Dr. Makai Alexandra

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Abbreviations

BS: Back School

BMI: Body Mass Index

BSP: Back School Program

BST: Biering-Sorensen Test

CG: Controlled Group

CI: Confidence Interval

cLBP: Chronic Low Back Pain

DALYs: Disability-Adjusted Life Years

ESCI: Emerging Sources Citation Index

GPAQ: Global Physical Activity Questionnaire

ICC: Intraclass Correlation Coefficient

ICF: International Classification of Functioning, Disability, and Health

ICIDH: International Classification of Impairments, Disabilities and Handicaps

IF: Impact Factor

IG: Intervention Group

KMO: Kaiser-Meyer-Olkin

LBP: Low Back Pain

LKQ: Low Back Pain Knowledge Questionnaire

LKQ-C: Concept part in Low Back Pain Knowledge Questionnaire

LKQ-GK: General Knowledge part in Low Back Pain Knowledge Questionnaire

LKQ-T: Treatment part in Low Back Pain Knowledge Questionnaire

MTFT: McGill Trunk Flexor Test

MR: Moderate Intensity Recreation

MW: Moderate Intensity Work

NLBP: Non-specific Low Back Pain

PA: Physical Activity

PROMs: Patient-Reported Outcome Measures

Q value: Modularity Q value

R-MDQ: Roland-Morris Disability Questionnaire

SD: Standard Deviation

SDI: Sociodemographic Index

sC-LKQ: simplified Chinese Low Back Pain Knowledge Questionnaire

SSCI: Social Sciences Citation Index

SCI-Expanded: Science Citation Index Expanded

S value: Silhouette value

TCM: Tradition Chinese Medicine

USA: the United States of America

VR: Vigorous Intensity Recreation

VW: Vigorous Intensity Work

WHO: World Health Organization

WOS: Web of Science

WOSCC: Web of Science Core Collection

YLD: Years of Life Lost Due to Disability

Abstract

Background

Low back pain (LBP) is a symptom that affects health globally and involves people of all ages. The increased sedentary behavior in modern life has also raised the risk of developing LBP. The Back School program (BSP), an intervention for LBP that originated in Sweden in the 1960s, has evolved over nearly half a century and has gained recognition for its efficacy in Europe and the United States. However, fewer studies have reported on the application of Back School in East Asia.

Aims

The main objective of this study was to measure the effectiveness of BSP, a combination of rehabilitation, education and training for the Chinese population. The specific purposes of the current research were divided into three sections. The first section was the cross-cultural adaptation and validation of the simplified-Chinese version of the LBP knowledge questionnaire, which measured LBP knowledge level. The second part was to explore the effects of the BSP on participants' physical performance, knowledge of LBP, physical activity, and disability of life. The third part extended the current topic, looking back at the history of LBP self-efficacy and investigating future trends and frontiers.

Methods

In the initial study of cross-cultural adaptation and validation of the LBP knowledge questionnaire, 431 people participated from September 2021 to June 2022. It was conducted on the Credamo online platform. The simplified Chinese LKQ (sC-LKQ) was generated through translation and cross-cultural adaptation guidelines. The participants were selected to fill out demographic questions, the sC-LKQ, and the Roland-Morris Disability Questionnaire (R-MDQ). The reliability and validity of the data were evaluated. The following step was to measure the effectiveness of BSP among Chinese in Hungary. Twenty-five volunteers participated, and four of them dropped out. Ten participants were in the intervention group and 11 in the control group based on

their schedules. Baseline data were collected from all participants before the intervention, including upper body physical examination, core and lower limb muscles examination, sC-LKQ, Global Physical Activity Questionnaire (GPAQ), and R-MDQ. Physical indicators and questionnaires were retaken after the 8-week theoretical combined practical Back School intervention. Comparing the results before and after the intervention and the differences between the two groups. Finally, there was a bibliometric analysis of LKQ self-efficacy. Raw data were selected from the Web of Science (WOS) database, the relevant literature on LBP self-efficacy were retrieved, and data were de-duplicated and cleaned. CiteSpace 5.8.R3 was used for bibliometric analysis and scientific mapping in publications, countries, institutions, journals, authors, references, and keywords.

Results

The cross-cultural adaptation and validation of sC-LKQ showed good internal consistency (Cronbach's alpha was 0.79), and the intraclass correlation value was 0.85. There were five components in the questionnaire with good construct validity. The scores of R-MDQ had negatively correlated with sC-LKQ. In an 8-week controlled study of BSP intervention, there was a statistically significant increase in the McGill trunk flexion test and knowledge of LBP (especially the basic knowledge and treatment section) in the intervention group. After the bibliometric analysis of LBP self-efficacy, there were 822 references included. For these 41 years, the total publication numbers were increased. A total of 103 regions had researchers in this area. The United States was the country with the largest volume of research. There were 94 disciplines, mainly in neuroscience. More research is likely to burst and develop quickly in general & internal medicine in the future. Spine was the most recognized journal. Cognitive behavioral manifestations and older adults with LBP might be the frontiers and trends.

Conclusion

In the Chinese population, the sC-LKQ demonstrated excellent psychometric qualities and could be used to evaluate self-efficacy in clinical practice and research. Meanwhile, the Back School-based intervention model positively impacts muscle performance in

the core area and knowledge acquisition of LBP in Chinese patients with chronic LBP. Regarding the bibliometric analysis result, the literature on LBP self-efficacy has increased linearly over the past 41 years and will continue to increase. The field of study has become more refined. This bibliometric analysis provides valuable support for future directions and research trends in LBP self-efficacy.

Keywords

low back pain, low back pain knowledge questionnaire, Back School, low back pain intervention, self-efficacy, bibliometric

Chapter 1 Introduction

1.1 Background

The Back School program (BSP) is a comprehensive educational and exercise-based approach to prevent and manage back pain. It was developed in Sweden for patients with low back pain (LBP) in 1969 [1]. After this, the BSP spread to the Americas and many other European countries [2]–[4]. The fundamental goal of BSP is to provide participants with the information and abilities they need to enhance their body mechanics, posture, and general back health. An important element of the BSP is that it helps individuals take responsibility for their health. It develops the skills and abilities so that the individual recognizes spine-friendly movements during daily movements. Many scheduled sessions covering a variety of subjects relating to back care and injury prevention make up the program's typical framework. An essential element of the BSP is the development of disease-specific knowledge, but there does not have knowledge assessment tool available in all languages. In some countries, there are also no language- and culture-specific BSP.

The main target of rehabilitation is to reduce disability, improve function, and return to life with a better living quality. In contemporary lifestyles, sedentary behavior has become one of the inevitable behavioral patterns in everyday life. Sedentary behavior has become more common as Covid-19 has led to more online activities [5], [6]. This lifestyle has contributed to the increasing frequency of low back pain [7]. While BSP is available in some countries and languages today, it is uncommon in developing countries, including China.

China has the second largest population globally, and LBP is also one of the most critical factors affecting the quality of people's daily lives [8]. Although there are many studies related to treating and rehabilitating LBP in China, there are no studies on BSP

intervention modalities. No content focuses on knowledge awareness of LBP-specific domains, apart from questionnaires that measure the physical function and status of patients with LBP, which remains a gap.

1.2 Purpose and Objectives

The purpose of this study was to investigate the impact of BSP on the Chinese in Hungary. BSP aims to help people with or without LBP improve body posture, increase muscle strength and flexibility, optimize the function of the spine, boost disease-specific knowledge, relief pain, and shorten the duration of back pain. The specific objectives are shown below:

(1) To complete the cross-cultural adaptation of the simplified Chinese version of the Low Back Pain Knowledge Questionnaire (sC-LKQ).
(2) To evaluate the validity and reliability of sC-LKQ among Chinese in China and Hungary.
(3) To determine the level of disease-specific knowledge of LBP among Chinese.
(4) To explore the impact of Chinese BSP among the Chinese people with chronic low back pain (cLBP) in Hungary.
(5) To determine whether the BSP will effectively impact Chinese participants in terms of physical function, knowledge of LBP, physical activity (PA), and disability of life in Hungary.
(6) To review the focus of previous LBP self-efficacy research.
(7) To explore future research directions and trends in LBP self-efficacy.

1.3 Theoretical framework

In this study, the intervention for adult Chinese participants with cLBP had the potential to change the behavioral habits of their daily lives. To properly understand the effectiveness of BSP intervention, it is crucial to obtain and track changes in

participants' physical indicators before, during, and after the intervention.

The current study is based on a combination of the social-ecological model and cognitive learning theory [9], [10]. Using the socio-ecological model, human behavior is influenced by intra-individual factors and the external environment, combined with the impact of self-efficacy on disease management in cognitive learning. Based on this integrated multidisciplinary model, this Chinese BSP intervention study focuses on the main factors: knowledge acquisition of LBP and improvement in back function (Figure 1).

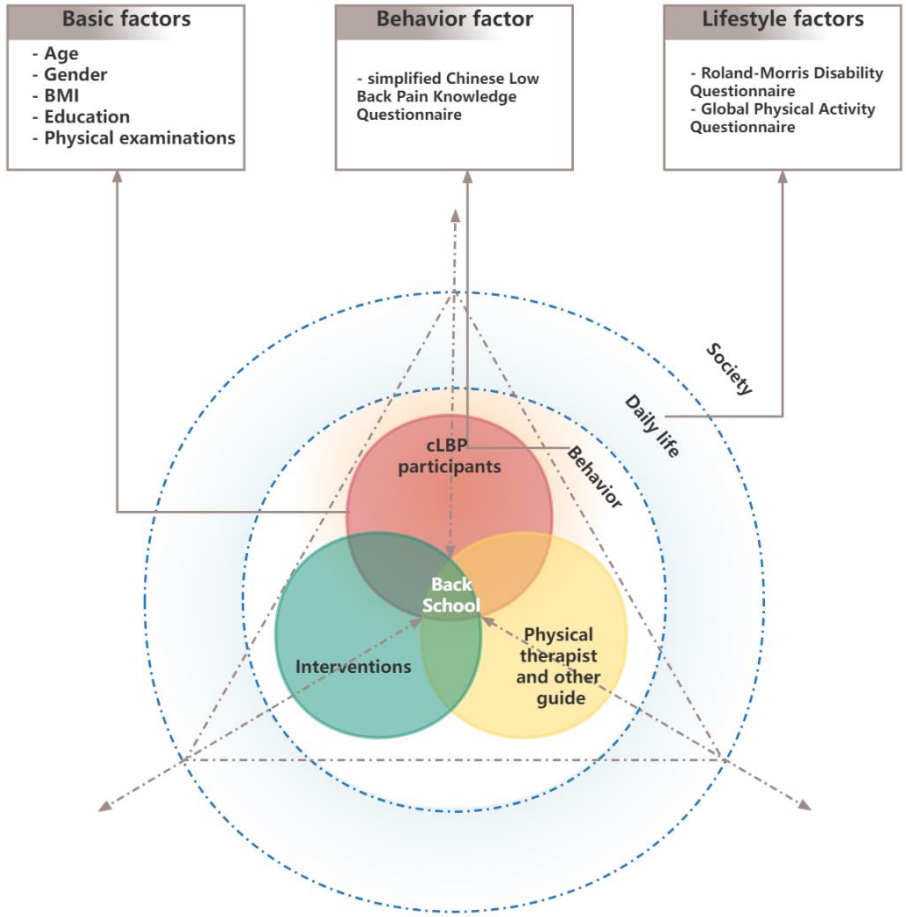

Figure 1 Framework of the current study

(Source: Own elaboration)

Chapter 2 Literature Review

This chapter reviews the literature concerned with the BSP status all around the world. It begins with the content of non-specific low back pain (NLBP), followed by BSP and self-efficacy.

2.1 Non-specific low back pain

2.1.1 Determination and Etiology

LBP is a symptom rather than a condition. It can be caused by various recognized or undiagnosed disorders or illnesses [11]. It is defined by the location of pain, commonly between the buttock creases and the lower rib borders [12]. Traditionally LBP is classified as acute, subacute, and chronic, depending on the duration of the pain. The corresponding periods are less than one month, 2-3 months, and more than three months [13]. Depending on whether there is a specific cause for the LBP symptoms, LBP can be subdivided into specific LBP and NLBP. NLBP suggests that there is no identified pathoanatomical etiology [14]. Triage aims to rule out cases where the pain is caused by conditions other than lumbar spine issues (such as a leaking aortic aneurysm), conditions affecting the lumbar spine specifically (such as an epidural abscess, compression fracture, spondyloarthropathy, malignancy, or cauda equina syndrome), or by radicular pain, radiculopathy, or spinal canal stenosis. The remaining patients have generalized low back discomfort. Although the intervertebral disc and facet joints, among other lumbar structures, are potential origins of pain, clinical testing cannot conclusively link the pain to those parts of the spine [15].

So far, determining the etiology of LBP remains unclear, mainly when more detailed subgroup studies are performed and the results are not directed [16]. This condition is more pronounced in NLBP, accounting for about 85%-90% of LBP [17]–[19]. But there is still a different view put up by Allegri et al.; they proposed that LBP can be attributed

to a specific pain generator in most cases, with its characteristics and with a different therapeutical opportunity such as radicular pain, facet joint pain, sacroiliac pain, pain related to lumbar stenosis, discogenic pain. It is undeniable that muscle tension and spasm are the most common causes of LBP [20]. Thus, LBP must always be treated as a complex disease that requires multidisciplinary cooperation for accurate diagnosis and treatment.

It is not just the LBP symptoms that cause pain in the patient's body, but the incidence of depression in patients with chronic pain is higher than in the general population throughout the course of LBP [21]. Many people with chronic LBP go through upsetting situations characterized by catastrophizing, passive coping, low self-efficacy, and high anxiety levels that are thought to predict and perpetuate chronicity [21]–[23]. The resolution of NLBP is a complex, dynamic, multidimensional process.

There are many risk factors for LBP, and because of its multiple dimensions, there is no convincing cause-and-effect relationship to date. Possible risk factors include genetics, age, smoking, history of back pain, job dissatisfaction, heavy physical activity, sedentary lifestyle, heavy lifting, vibration, obesity, and psychosocial factors [7].

2.1.2 Epidemiology

In a 2008 review of 165 research from 54 countries that investigated the prevalence of LBP globally, the mean point prevalence was 18.3%, and the 1-month prevalence was 30.8% [24].

LBP is the principal cause of years lived with disability in all high-income nations. It is also one of the leading causes of years lived with disability in 65% of all countries worldwide [25]. Additionally, there was a 54% rise in years lived with a handicap between 1990 and 2015, with low- and middle-income nations seeing the most significant jump in this statistic [26].

The Global Burden of Diseases, Injuries, and Risk Factors Study presented a systematic scientific evaluation of published, openly accessible, and donated data on incidence prevalence and mortality for a list of illnesses and injuries that are mutually exclusive and comprehensive as of 2019. It reported two parameters associated with LBP: incidence and disability-adjusted life years (DALYs). Among all the ages for both sexes, LBP shows an increasing trend from No.13 to No.9 between 1990-2019 in the leading causes of DALYs. It is the top 4 cause for ages 10-49 in 2019 [25]. It illustrates the important impact of LBP on people of all ages, particularly adolescents and adults under the age of 50. The prevalence of this phenomenon increases progressively with the development of time. Based on the data from this study, further analysis was performed by Jiehua et al. to provide an overview of the epidemiological trends in LBP at the global, regional, and different country levels, respectively. They reported that the number of LBP cases worldwide grew by 50% between 1990 and 2019, from 149,294,134,47 to 223,455,640.82 instances. The overall age-standardized incidence rate consistently shows a declining trend. In low-middle sociodemographic index (SDI) regions, the age-standardized incidence rate of LBP reduced the highest. South Asia, East Asia, and Australia saw the greatest declines in the age-standardized incidence rate of LBP. Male respondents had a lower incidence than females. The countries with the biggest reductions in the age-standardized incidence rate and DALYs rate of LBP were China and India. Also, a greater burden of LBP was noted in elderly people and females [27]. Meanwhile, Jiehua and their research group also published a study to analyze the spinal pain situation in China and forecast incidence trends to 2030. Similar to the worldwide trends, the LBP age-standardized incidence rate considerably declined in both male and female respondents from 1990 to 2019 in China. All age groups saw a decline in LBP incidence rates. According to the age effects, the relative risks of LBP incidence rose with age. The age-standardized incidence rate of LBP grew in male individuals but reduced in female ones [28].

There have been several previous studies addressing the epidemiology of LBP in China. Dong et al. made a systematic review of the prevalence of LBP in the adult population in China. They finally included 16 studies with 99,920 participants from 1,548 relevant research. The results showed that significant heterogeneity had been observed among the different studies. Prevalence among those previously impacted ranged from 7.21% to 39.00%, annual prevalence ranged from 20.88% to 29.88%, and the time period prevalence was 6.11% to 28.50%. Only one study revealed a slightly greater incidence in men, whereas the other five found a higher prevalence in women. Six studies examined the differences in prevalence between the genders [8].

Health insurance expenses due to LBP have never been negligible. As for the United States of America (USA), LBP and neck pain, and diabetes had the highest increases (in absolute terms) in 2016. From 1996 to 2016, the expenses for LBP and neck pain increased annually by 6.70%, and the number of prevalent cases increased by 1.10% yearly, but the health burden increased by only 1.30% per year [29]. Among 154 conditions, LBP and neck pain had the highest healthcare spending, with an estimated 134.5 billion dollars [30].

Similarly, there has been a study that reported the burden of LBP in China between 1990 and 2016. The years of life lost due to disability (YLD) in China was 13,944,000 person-years, the spinal pain (including LBP and neck pain) occupied 11.60%, around 1,624,300 person-years which ranked the top in 2016. Skeletal muscle disease has been a significant disease affecting the quality of life among people in all regions of China and has severely restricted the improvement of healthy life expectancy of Chinese people. The financial burden of LBP can also be enormous [31]. Therefore, LBP is a global public health problem that needs urgent solutions.

2.1.3 Intervention

Because of the multiple underlying causes of LBP, it is destined to require a

multidisciplinary and comprehensive treatment plan. However, interventions for LBP are not without experience. On the contrary, a widely recognized clinical practice guideline published in 2007 has a detailed strategy for medical professionals from diagnosis to treatment [18]. After the diagnosis is confirmed, most patients use acetaminophen or nonsteroidal anti-inflammatory medicines as first-line treatment alternatives. It is also important to combine back care information and self-care. Further, if LBP symptoms do not improve, for chronic or subacute LBP, intensify interdisciplinary rehabilitation [32], exercise therapy [33], acupuncture [34], massage therapy [35], yoga [36], cognitive behavioral therapy [37], or progressive relaxation [38]. Similarly, the research by Becker et al. summarized the recommendations for clinical practice in NLBP, graded by level of evidence (Table 1) [39]. A meta-synthesis research about chronic LBP also mentioned that the major strategies were physical therapies, medication, and avoidance behaviors. However professional and family support, self-efficacy, and motivation influenced pain experiences. The intervention process should also consider psychological therapies, education and self-management [40].

Published in 2018 in the European Spine Journal, the updated clinical practice guideline for primary care for NLBP increases the importance of assessing psychosocial factors, recommendations for the use of paracetamol analogs, and has new insights regarding types of exercise, acupuncture, herbs, and invasive treatments [50]. In 2020 the North American Spine Society developed evidence-based medical guidelines for NLBP [51]. The guideline focuses on five areas: diagnosis, imaging, conservative management, interventional and surgical management. In the section on physical therapy, Back School (BS) is also recommended as a multidisciplinary model of intervention. In 2021, the American Physical Therapy Association updated its clinical practice guidelines for LBP [52]. The guidelines emphasize exercise therapy, manipulation, and patient education as the best of treating LBP. Special emphasis was placed on patient education to help patients understand the factors that contribute to LBP, the principles of LBP

relief, the proper way to move, and avoiding LBP.

Table 1 Sort: Key Recommendations For Practice [39]

Clinical recommendation	Evidence rating	Comments
Red flags can help rule out serious underlying etiologies of LBP [41], [42].	C	Consensus guideline
Back braces and insoles do not prevent LBP [43]–[46].	A	Systematic reviews of multiple randomized controlled trials
Core strengthening exercises can prevent LBP [47].	B	Cochrane review of low- to moderate-quality studies
Yoga can improve chronic LBP [48].	B	Cochrane review of low- to moderate-quality studies
Physical activity is an effective treatment of LBP [49].	B	Cochrane review of moderate-quality studies

A = consistent, good-quality patient-oriented evidence; **B** = inconsistent or limited-quality patient-oriented evidence; **C** = consensus, disease-oriented evidence, usual practice, expert opinion, or case series.

2.1.4 Measurement and scales

Patient-reported outcome measures (PROMs) are promising tools for diagnosing conditions and assessing the effectiveness of interventions before the treatment. It can provide the necessary information without requiring clinical staff to conduct examinations or interviews, saving costs [53]. It is already used for the purpose of musculoskeletal research and practice [54], [55].

Three characteristics of the illness were taken into consideration by the 1980 World Health Organization (WHO) International Classification of Impairments, Disabilities and Handicaps (ICIDH): (1) Disabilities relating to loss or abnormality of bodily

structure or function. (2) Disabilities relating to individual skills, and (3) Disabilities relating to societal activities [56]. These three dimensions are independent of each other, and there is no causal relationship between each one but there are correlations. On this basis, the International Classification of Functioning, Disability, and Health (ICF) was introduced by the WHO in 2001. Three essential areas include (1a) physical functioning and (1b) structure, (2) activity and involvement, and (3) personal and environmental, which make up the physical, personal, and social [57]. These four elements (items 1a, 1b, 2, and 3) each can include a domain that might be a sign of sickness. For NLBP, which may cause long-term discomfort and affect life, social activities, mind, and body, the choice of tools used to measure the patient's symptoms must stand in multiple contexts, aiming to improve the patient's quality of life.

As early as 1998, Dayo et al. proposed a model after considering reliability, validity, responsiveness, practicability, and compatibility for integrating the assessment of patients with LBP. They suggested measuring the five core indexes: the function of the back, symptoms of discomfort, general health state, inability to work, and satisfaction with care [58]. It has also been observed in Bombardier's research, and in certain circumstances, based on the patient's performance, other measures in addition to the five points above should also be considered [59].

2.2 Back School program

2.2.1 Origins and Development

The BSP first started at a hospital in Stockholm in 1969. It aimed to improve the LBP patients' ability to take care of their backs by teaching helpful knowledge, especially in ergonomics, over four classes for around two weeks [1]. Within ten years, the BSP model had spread to the USA, Australia, and over 300 Scandinavian low back care facilities [1], [2], [60].

Before 1990, using the Swedish BSP as a basis for practice, clinicians and researchers in other countries developed different BSP according to local conditions, such as California BSP, Canadian Back Education, and Maastricht BSP [2], [3], [61]–[63]. In addition to sections similar to the Swedish BSP, some studies added occupational therapy [61], guidance on activities of daily living and training [2], emotional and relaxation training [3], [62], and education and training on psychological factors[3], [63]. Project interventions ranged from 1-7 weeks and lasted 45 minutes and 2.5 hours each. The number of interventions also ranged from 1-7 sessions [2], [3], [61]–[66]. After more than 20 years of clinical practice, the format the content of the BSP had thus basically formed a relatively fixed model framework.

Since the 1990s, with the development of evidence-based medicine, more studies have discussed the effectiveness of the BSP, leading to a gradual increase in its impact worldwide [67]. To this day, research is still ongoing due to the differences in place, target group, approach, and specifics of the implementation of the BSP [68].

Initially, BSP provided information about the anatomical structure and function of the back, discussed mechanical strain in different positions and instruction in abdominal exercises, and was encouraged to increase participants' activity levels during leisure time [66]. Today, BSP is multidisciplinary in content [69]. This approach involves collaboration between different healthcare professionals, such as physical therapists, chiropractors, occupational therapists, and pain specialists, to provide a holistic treatment plan tailored to individual needs. In recent years, there has been a growing recognition of the psychosocial factors influencing back pain. Back School programs now address not only the physical aspects but also the psychological and social aspects of back pain. This includes addressing stress management, coping strategies, and providing support for emotional well-being [70]. Meanwhile, BSP initiatives now place a strong emphasis on patients taking an active role in their healing [70], [71]. Participants are encouraged to engage in activities and self-management strategies

rather than passively taking in information. With this proactive approach, people may take charge of their back health and avoid further issues.

The development of BSP has seen an integration of evidence-based practices, a multidisciplinary approach, active patient involvement, and psychosocial concerns. These advances have increased the BSP program's potency and relevance in treating back pain and fostering long-term back health.

2.2.2 Specific methods and contents

BSP is a multidiscipline educational program [69]. It typically consists of a series of sessions led by healthcare professionals, such as physical therapists. The specific methods and contents of BSP may vary, but it still has a general model[1]–[3], [72]–[76].

(1) Overview of Back Pain:

a. Knowing the spine's structure and the typical causes of back discomfort.

b. Highlighting the value of back health and the influence of lifestyle choices.

(2) Position and ergonomics:

a. Teaching good posture and body mechanics for a range of actions (such as lifting, bending, and sitting).

b. Giving instructions on how to set up workstations, seats, and other equipment for the best possible ergonomics.

c. Demonstrating stretches and exercises to enhance posture and release muscle tension.

(3) Using safe lifting techniques and body mechanics:

a. Teaching trainees the "bend and lift" technique and other safe lifting practices.

b. Emphasizing the importance of using the core muscles while lifting and distributing the weight appropriately.

c. Focusing on avoiding jerking or twisting actions that create tension on the back.

(4) Exercise and physical fitness:

a. Suggested exercises to build up the abdomen and back muscles, which support the spine.

b. Exercise progression and good technique should be taught, and participants' limits should be made clear.

c. Examining the advantages of aerobic workouts and general fitness for back health.

(5) Management of Pain and Self-Care:

a. Introducing numerous pain-management and injury-prevention practices, such as heat or cold treatment, breathing exercises, and stress management.

b. Instructing participants on how to properly use their bodies when doing things like sleeping, standing, and eating.

c. Promoting assistive products (such as ergonomic pillows and lumbar supports) to provide additional back support.

(6) Injury avoidance:

a. Identifying variables that increase the incidence of back injuries and offering preventative measures.

b. Highlighting the need to keep a healthy weight, do frequent exercise, and avoid staying inactive for extended periods.

c. Giving individualized solutions and addressing specific professional or lifestyle issues that may cause back discomfort.

(7) Environment-specific ergonomics:

a. Adjusting the program to consider certain situations or activities that participants partake in (for example, workplace ergonomics, lifting in a warehouse, sports-related motions).

b. Giving instructions on how to change the setting or machinery to boost back health in those particular circumstances.

Participants may take part in practical demonstrations, hands-on exercises, and engaging conversations throughout the BSP to reinforce the topics presented. The program aims to provide participants with the knowledge and abilities they need to

choose the best back care options and avoid further back pain episodes.

2.2.3 Current status

It has been 54 years since the first time that BSP was practiced in Sweden in 1969 [1]. Initially, the clinical application of the BSP was mainly in the treatment of LBP, providing patients with relief from symptoms and pain. As it developed, the practice of the BSP considered the prevention of LBP. To this day, there are still different studies focused on BSP. The effectiveness of BSP for cLBP is unclear, according to the latest Cochrane review [77]. At the same time, the role of BSP remains worthy of more investigation due to the diversity of contents and the different outcomes produced by different variants. Similarly, Straube et al. reported insufficient evidence to support the use of BSP to treat cLBP. In the over 50 years of the initial trials of BSP, no conclusive proof of benefit has been found [68]. Even so, the BSP is still in use today in clinical work worldwide; its influence cannot be ignored, and many scholars are still working on it.

In Sweden, where the BSP originated, BSP has already become one of the general treatments for LBP [78]. Especially after 1990, compared with general BSP, they proposed several studies about Mini BSP [79]–[81]. In the Mini BSP, they removed the exercise part with a shorter intervention time. The content of the theory section in Mini BSP was almost identical to the usual outline. The Mini BSP was effective in follow-up but also limited.

The USA, Canada, and Australia are also in the first group of countries to practice the BSP [2], [4], [60], [62]. However, the USA BSP focused on teaching participants to maintain the lumbar lordosis while lifting in 2 to 3-hour lectures through anatomic audiovisual aids [82]. The effectiveness of this USA BSP has been confirmed [82]. General Sweden BSP was also acceptable in the USA and still be recognized [83], [84]. Since the 1980s, when Canadian clinical staff started using BSP as an intervention [62],

it has been focused on in Canada in the 1990s. Canadian researchers have concentrated on the BSP as a rehabilitation intervention for workers and ordinary LBP patients with LBP [85]–[87]. Their model for conducting BSP followed the same pattern as the Swedish BSP, but in 2005 it was suggested that the methodology needed to be optimized to make BSP more cost-effective [88]. It is worth noting that although the BSP was also conducted in Australia in 1980, there are not many studies related to local patients, and only one Australian researcher compared BSP to other intervention methods, such as the Mckenzie Exercise, to investigate the effectiveness of two methods and the results during the follow-up appointments within six months [89]–[92].

Research on the BSP has been carried out not only in these early adopters but also in other parts of the world, such as Europe (Germany [93], the Nordic region [94], [95], Spain [96], [97], Italy [98], [99], Hungary [100], etc.), some Asian countries (Japan [101], Iran [102], Turkey [103], etc.), and South America (Brazil [104]).

In our previous BSP intervention study in Hungarian patients with cLBP, it was found that those who were educated about the LBP-specific knowledge had an increased level of physical activity, improved knowledge and understanding of the LBP, and a reduced level of disability of pain [105].

The BSP has been implemented in many countries around the world. It may vary based on geography from region to region. The BSP can commonly be offered in hospitals, physical therapy clinics, rehabilitation centers, or occupational health settings when needed by leading physical therapists, chiropractors, or occupational therapists. Both acute and chronic LBP patients can attend the BSP. The content of the BSP can also be modified and tailored to suit the needs of different occupations and lifestyles. With the advent of technology, the BSP has become more diverse in providing information, from the initial projection medium to the current knowledge booklets, electronic audio, and video materials. Research studies have evaluated the effectiveness of LBP prevention

and management methods. These programs employ evidence-based techniques to ensure they are founded on academic study.

2.3 Self-efficacy

2.3.1 Definition and conceptual framework

Self-efficacy is a key construct within social cognitive theory. It was defined as the belief that one can effectively execute a course of action in a particular scenario to create a desired result by psychologist Albert Bandura in 1977 [106].

According to Bandura's research, the conceptual framework of self-efficacy is grounded in social cognitive theory. There are four primary sources of efficacy information: mastery experiences (i.e., successful or unsuccessful performances), vicarious experiences (i.e., observing others' performances), social persuasion (i.e., verbal or nonverbal feedback from others), physiological and affective states (i.e., bodily sensations or emotional reactions) [107].

2.3.2 Self-efficacy in LBP

In the social learning theory, people will engage in coping efforts that they believe are within their capabilities which will result in positive consequences [108]. Most LBP, especially cLBP, has a long duration of symptoms and a prolonged impact on daily life. The relief of symptoms and pain depends not only on external environmental factors but the ability to manage oneself is also an important part of the healing process. Self-efficacy in LBP refers to an individual's belief in their ability to effectively manage and cope with their symptoms.

A broad overview of the relationship between self-efficacy and chronic pain. A meta-analysis of this was done in 2014 by Todd Jackson et al [109]. The study included a

sample of 86 (covering 15,616 participants). Although there was considerable heterogeneity in the included studies, self-efficacy was negatively associated with pain levels. This suggests that self-efficacy is a potentially critical factor in subsequent feedback in groups affected by chronic pain. A similar result was reported in another multivariate meta-analysis in 2022, especially focusing on non-specific LBP [102] and suggesting that the effect sizes of studies relating self-efficacy to LBP will be more quantitative.

Started in 1993, Altmaier et al. studied the rehabilitative effects of self-efficacy beliefs in 45 patients with LBP who participated in a 3-week rehabilitation program [110]. The results of this study showed that although increased self-efficacy beliefs during rehabilitation were not associated with improved patient functioning at the end of the intervention, increased self-efficacy gave better patient functioning in daily life and fewer pain recurrences at the half-year follow-up. Even though it did not include a very high number of participants, the longitudinal nature of the data supported the significance of self-efficacy for the rehabilitation of patients with LBP was broadly revealed. Regarding specific indicators, one study found a moderate negative correlation between self-efficacy and pain intensity and a strong negative correlation with disability level [111]. It means that the higher the self-efficacy, the lower the level of disability and pain. Poor musculoskeletal health and pain intensity may contribute to reduced self-efficacy, but the primary determinant of reduced self-efficacy is the low back-related disability score. Similar results were seen in another study with indicators of LBP rehabilitation under the influence of different levels of self-efficacy [112]. The cross-sectional study reported that people with high self-efficacy for cLBP had less pain, greater range of motion, better function, and less influence from psychological factors.

The impact of self-efficacy on people with LBP includes physical and psychological aspects. The majority of current research focuses on analyzing the outcomes of self-efficacy in the treatment of LBP. People can develop confidence in regulating and

coping with pain through cognitive behavioral therapy, education, and graded exercise programs. These therapies increase self-efficacy, which empowers people to actively participate in rehabilitation, encourage increased functioning, and cultivate a positive outlook on managing LBP. In conclusion, self-efficacy is vital to understanding, managing, and minimizing the effects of LBP. Better pain management, better functional results, and increased psychological well-being may be related to higher self-efficacy. Lower self-efficacy, on the other hand, might result in avoidance behaviors and unfavorable psychological effects. Through focused treatments, self-efficacy promotion can assist people in managing and reducing the impacts of LBP and expects to have a positive impact on the long-term prognosis.

2.4 Research Gap

Previous literature has described the impact of LBP on daily life and function, the importance of self-efficacy as an intervention modality for LBP that affects the performance in rehabilitation outcomes, and the use of BSP as a multidisciplinary intervention in selected countries around the world. However, there are currently no studies discussing the use and impact of BSP in China, nor are there many validated tools measuring self-efficacy related to LBP. As a country with a large population, the prevalence and impact of LBP is not low.

The purpose of this dissertation is to validate a simplified Chinese version of the LBP Knowledge Questionnaire (LKQ), which serves as a measure of self-efficacy. Additionally, it seeks to explore the potential use of BSP as an intervention specifically for the Chinese population. The primary goal is to introduce innovative rehabilitation tools to Chinese physiotherapists, aiming to enhance the overall rehabilitation process and improve the well-being of patients in China who suffer from LBP.

Chapter 3（Sub-study 1)

Adaption and validation of simplified Chinese version of the Low Back Pain Knowledge Questionnaire (sC-LKQ)

3.1 Introduction

The LBP has been one of the major factors affecting years lived with disability globally for the past three decades and carried a large public health burden [113]–[115]. Understanding the disease-specific aspects of LBP is crucial for preventing and treating spinal diseases [116], [117]. Some researchers have found a link between disease-specific knowledge with effective prevention and rehabilitation [105], [118]. Therefore, knowledge of specific diseases can be developed through educational programs and measured through knowledge questionnaires. Knowledge about the prevention and rehabilitation of spinal disorders can be assessed with the LKQ originally developed by Maciel et al. in 2009 [119]. It was translated and validated into the Arabic (2017) and Hungarian (2019) languages [120], [121].

In China, the prevalence of LBP is increasing because of the population's higher mean age and life expectancy [122], [123]. Spinal pain is anticipated to worsen the public health burden with population aging [28]. The prevalence of LBP does not have a specific population pattern; it shows in different occupations [124], [125] and has even become one of the health concerns of adolescents [126]. It is important to improve knowledge of LBP disorders. The sC-LKQ has not been validated, and clinicians do not have an efficient tool to assess LBP knowledge. This study aimed to translate and validate the original LKQ into simplified Chinese and also explored the characteristics among the participants.

3.2 Methods and Materials

3.2.1 Participants

Four hundred thirty-one participants participated in the cross-sectional quantitative study in China and Hungary between September 2021 and June 2022. The number of participants who met the criteria for conducting the health questionnaire [127]. The inclusion criteria were as follows: (1) older than the age of 18; (2) native Chinese speakers living in China or Hungary. The Exclusion criteria were as follows: (1) a history of tumors, current low back infection, and other conditions linked explicitly to pain; (2) inability to complete the questionnaire independently; and (3) learning difficulties or dyslexia.

Of these, three participants were excluded because of improper completion of the questionnaire. Finally, we ultimately included data from 428 participants. Data were collected online using the Credamo questionnaire platform. The study was approved by the Local Ethics Committee of Chengdu Sports University Hospital No.2020002 and the Institutional Review Board of the Regional Research Committee of Clinical Center at the University of Pécs No. 8342-PTE 2020 (Appendix 8). All participants signed the informed consent form (Appendix 2).

All the participants were divided into six groups: Group 1: healthy people without health sciences or medical education background in China. Group 2: healthy people with health sciences or medical education backgrounds in China. Group 3: LBP patients who received ambulatory treatment in China and had LBP confirmed by imaging examination. Group 4: people with an LBP history within one year in China. Group 5: healthy Chinese people living in Hungary with health sciences or medical education backgrounds. Group 6: healthy Chinese people living in Hungary without health sciences or medical education backgrounds.

Sixteen participants were chosen randomly from the entire sample to test the repeatability of the instruments.

3.2.2 LKQ Translation and cross-cultural Adaptation

The LKQ translation into a simplified Chinese version was authorized and permitted by inventor Maciel. The whole translation and validation process was performed according to Beaton's guidelines for the process of cross-cultural adaptation of self-report [128]. It includes six steps: translation, synthesis, back translation, getting in common through an expert committee, testing the prefinal version, and obtaining the final version (Figure 2).

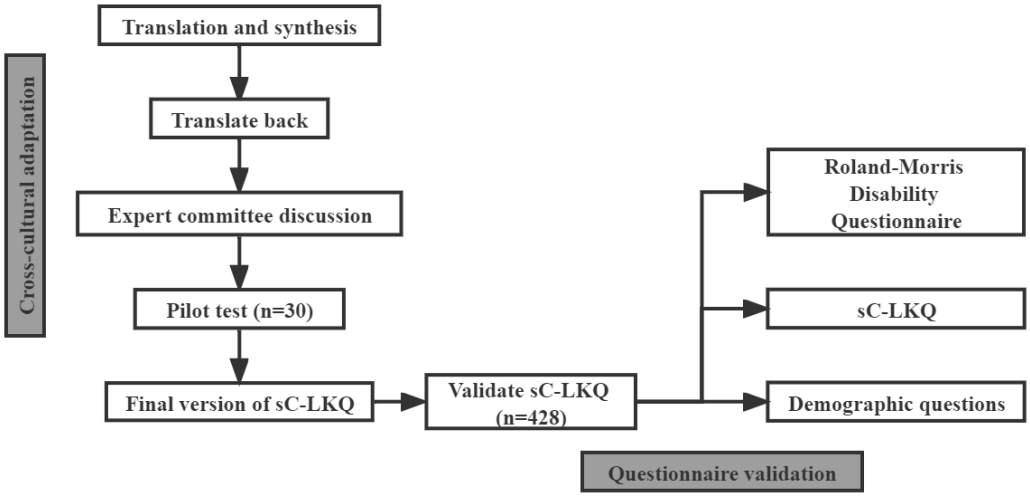

Figure 2 Flowchart of cross-cultural adaption and validation of sC-LKQ

Two independent experts with a multilingual medical educational background translated the LKQ English version into a simplified Chinese version. Only one of them was a physiotherapist who knew the details of the LKQ. Based on the two translated questionnaires, the initial questionnaire was integrated by a team of physiotherapists and translators. Two translators majored in English translated the initial sC-LKQ back to English, respectively. The back-translated questionnaires were compared with the original LKQ to ensure no ambiguity in the Chinese version. The initial sC-LKQ was

again modified according to the results of Chinese comparison and language habits. After evaluation and revision by a team of experts, the pilot test sC-LKQ was obtained.

Thirty participants aged over 18 years participated in the pilot test of the sC-LKQ. All the respondents could understand the meaning of each item and complete the questionnaire. The final version of the sC-LKQ was generated.

3.2.3 Instruments

Two LBP-specific questionnaires and a demographic questionnaire created by our team made up this investigation.

3.2.3.1 The Low Back Pain Knowledge Questionnaire (LKQ)

The original LKQ consists of 16 questions in three dimensions: general knowledge (Q1, Q6, Q7, Q8, Q15), concepts (Q2, Q3, Q4, Q5), and treatment (Q9, Q10, Q11, Q12, Q13, Q14, Q16) of LBP, for a total of 24 points. It comprises eight single-choice and eight double-choice questions. Each question has five options, with one point indicating the correct answer. A higher score implies higher knowledge about LBP.

3.2.3.2 The Roland-Morris Disability Questionnaire (R-MDQ)

In 1983, Roland and Morris developed the earliest R-MDQ from the Sickness Impact Profile to a 24-item self-administration questionnaire, especially for back pain [129]. Its scores range from 0 (without any disability) to 24 (maximum disability) to evaluate the impact of pain during daily life. The simplified Chinese version of the R-MDQ is reliable and valid as an LBP self-reported measurement tool in Mainland China [130].

3.2.4 Data Analyze

Microsoft Office Excel 2019 was used for data organization. Further statistical analysis was conducted using IBM SPSS 28.0 (SPSS Inc, Chicago, USA). Scores on demographic indicators and items in the questionnaires were analyzed using descriptive

statistics with expressed mean values and standard deviation (SD). Correlation analysis was performed to compare the association between demographic characteristics and sC-LKQ. A p-value lower than 0.05 was regarded as statistically significant.

Cronbach's alpha coefficient value was used to measure the internal consistency, and an alpha value higher than 0.70 indicated an acceptable internal consistency [131]. The intraclass correlation (ICC) and Bland-Altman graph with a 95% bound of the agreement were used to evaluate test-retest reliability. ICC value less than 0.5, between 0.5 and 0.75, and between 0.75 and 0.9 was considered poor, moderate, and good test-retest reliability, respectively [132].

To assess the construct validity of the sC-LKQ through an exploratory factor analysis by the principal component with varimax rotation. The Kaiser-Meyer-Olkin (KMO) test was used to measure sampling adequacy of 0.6, and Bartlett's test of sphericity significance level 0.05 was performed to establish the data sufficiency for structure identification and adequacy for principal component analysis [133].

Groups 1 and 2 (Chinese in China) were analyzed for differences with Chinese in Hungary, represented by Groups 5 and 6, using the Mann-Whitney U test. The significance level was set at $p<0.05$.

3.3 Results

Of the 428 Chinese participants (183 males, 245 females) mean age was 30.90±11.30 years old. The demographic characteristics are illustrated in Table 2. The score of sC-LKQ was 14.25±4.42. In the specific classification of the three blocks in sC-LKQ, the score of general knowledge was 5.45±1.71 (total 9), the concept was 2.17±1.13 (total 4), and the treatment was 6.62 ± 2.35 (total 11). A total of 137 participants had manifestations of LBP in the last 24 hours at the time of testing (R-MDQ score higher

than 0). The scores in the six groups in the study are shown in Table 3. There were 264 participants without a medical education background who got 12.87±4.53 points in sC-LKQ. The general knowledge part scored 4.98±1.80, concepts scored 1.86±1.06, and treatment scored 6.03±2.43. Other 164 participants with medical education background got 16.46±3.16 points in total and got 6.21±1.22, 2.68±1.05, and 7.57±1.85 points in three sessions separately.

Table 2 Demographic characteristics of participants

Variable	Mean (SD) or N (%)
Age (Ys)	30.895 (11.297)
Gender	
Male	183 (42.8)
Female	245 (57.2)
Education level	
Primary school	5 (1.2)
Middle school	14 (3.3)
High school	34 (7.9)
College	68 (15.9)
Bachelor degree	234 (54.7)
Master degree	64 (15.0)
P.hD. degree	9 (2.1)
Medical education background	
Yes	164 (38.3)
No	264 (61.7)

SD: standard deviation; N: number

3.3.1 Internal consistency and test-retest reliability

The sC-LKQ showed acceptable internal consistency, the Cronbach's alpha coefficient was 0.79. The ICC value was 0.85 (95% CI, 0.61-0.94), reflecting good test-retest

reliability of sC-LKQ. The Bland-Altman plot graph is shown in Figure 3, with a mean value of -0.13±2.34 (95% limits of agreement, -4.70 to 4.45). There was no significant proportional bias between the test and retest.

Table 3 Scores of the different subcategories of sC-LKQ

	Number	sC-LKQ score	General knowledge	Concepts	Treatment
Group 1	66	14.83±2.92	5.77±1.23	2.12±0.83	6.94±1.74
Group 2	78	16.95±3.05	6.21±1.22	2.79±1.01	7.95±1.69
Group 3	61	12.33±5.05	4.56±1.98	1.92±1.16	5.85±2.76
Group 4	64	14.83±3.00	5.77±1.24	2.14±0.81	6.92±1.79
Group 5	64	16.50±2.77	6.37±1.18	2.66±1.03	7.47±1.64
Group 6	95	10.94±4.93	4.36±1.91	1.56±1.24	5.01±2.60
All	428	14.25±4.42	5.45±1.71	2.17±1.13	6.62±2.35

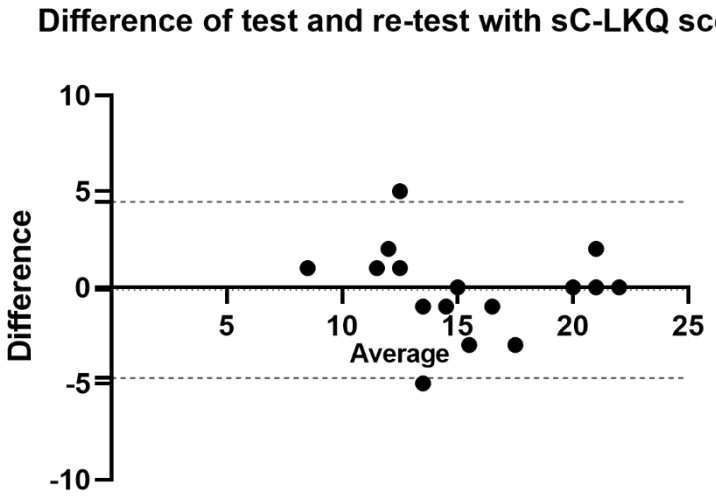

Figure 3 Bland-Altman plot of sC-LKQ score between test and retest

3.3.2 Construct validity and concurrent validity

The KMO value was 0.864, and Bartlett's test value of 1225.442 ($p<0.0001$) indicated that the data were suitable for factor analysis. Five components with eigenvalues greater than 1 occupied 53.67% of the cumulative rotation sums of squared loadings. The items showed factorial loads ranging from 0.321 to 0.835 (Table 4).

In the correlation analysis, R-MDQ was found to be significantly and negatively

correlated with the sC-LKQ score (r=-0.121, p=0.012), level of education (r=-0.201, p<0.001), and those without a medical education background (r=-0.097, p=0.046). Macroscopically, the sC-LKQ score was statistically positively correlated with the level of education (r=0.102, p=0.035) and medical background (r=0.407, p<0.001). In terms of the coverage of the three modules of the sC-LKQ, the R-MDQ was negatively and significantly correlated with scores in the category of general knowledge (r=-0.174, p<0.001). Age had no statistically significant effect on the sC-LKQ and R-MDQ (Table 5).

Table 4 The principal component analysis of sC-LKQ

	Component					
Items	1	2	3	4	5	Communalities
Q1	**0.531**	-0.008	-0.113	**0.501**	-0.039	0.548
Q2	0.222	-0.007	-0.237	-0.274	**0.809**	0.835
Q3	**0.598**	-0.193	-0.164	0.073	0.041	0.428
Q4	**0.625**	-0.224	-0.203	0.120	-0.176	0.528
Q5	**0.457**	0.122	0.019	**0.462**	0.070	0.443
Q6	0.247	-0.154	**0.748**	0.305	0.210	0.781
Q7	**0.463**	-0.204	**0.426**	-0.122	0.186	0.486
Q8	0.230	**0.758**	0.058	0.126	0.101	0.657
Q9	**0.467**	-0.259	-0.014	-0.321	-0.248	0.450
Q10	0.384	**0.578**	0.152	-0.277	-0.209	0.625
Q11	**0.523**	0.088	0.315	-0.339	-0.138	0.515
Q12	**0.505**	0.249	-0.217	0.017	0.220	0.413
Q13	**0.522**	0.146	-0.081	-0.015	-0.212	0.346
Q14	**0.507**	-0.073	-0.196	0.111	-0.087	0.321
Q15	**0.793**	-0.167	-0.054	-0.139	0.005	0.678
Q16	**0.715**	-0.023	0.017	-0.136	0.059	0.533

3.3.3 Differences between Chinese in China and Hungary

There were 144 healthy Chinese participants in China and 159 in Hungary. After the Mann-Whitney U test, a significant statistical difference existed between Chinese people in China and Hungary (p<0.001) in the sC-LKQ score. Chinese in China (15.98 ±3.16) had higher sC-LKQ scores than Chinese in Hungary (13.18±5.00).

Table 5 Correlation analysis of sC-LKQ, R-MDQ, and demographical factors

	sC-LKQ	R-MDQ	Age	Education level	Medical background	General knowledge	Concepts
R-MDQ	-0.121*						
Age	-0.078	0.056					
Education level	0.102*	-0.201**	-0.121*				
Medical background	0.407**	-0.097*	-0.299**	0.047			
General knowledge	0.831**	-0.174**	-0.078	0.105*	0.352**		
Concepts	0.723**	-0.088	-0.062	0.006	0.369**	0.502**	
Treatment	0.889**	-0.072	-0.040	0.110*	0.336**	0.584**	0.495**

**. Correlation (r) is significant at the 0.01 level (2-tailed).

*. Correlation (r) is significant at the 0.05 level (2-tailed).

3.4 Discussion

Self-efficacy is an important factor affecting chronic diseases. Patient knowledge is an essential component of primary prevention [134]. Clinical practitioners in many countries have focused on the application and impact of LBP knowledge within the framework of their culture and have developed or validated scales to measure LBP knowledge [119]–[121], [135]. However, there is a lack of validation for the Chinese LKQ. The purpose of this study was to complete the cross-cultural adaptation and reliability validation of the sC-LKQ to determine the characteristics of the scores in

participants' feedback.

The final version of the sC-LKQ was obtained after strict adherence to the steps of the Beaton cross-cultural study and pretesting to accomplish the trans-cultural adaptation of the LKQ [128]. The demographic characteristics, sC-LKQ and R-MDQ, were assessed in 428 participants. The sC-LKQ showed acceptable internal consistency (Cronbach's alpha=0.783) among 16 items. It is higher than the result of the original English questionnaire (Cronbach's alpha=0.71) [119] but lower than that of the Hungarian (Cronbach's alpha =0.894) and one of the Arabic (Cronbach's alpha=0.834) versions [120], [121]. In another study verified by Jordanian scholars in the Arabic version of LKQ in 2021, Cronbach's alpha was 0.707 [135]. Notably, in a previous cross-sectional study performed by Chinese researchers, they derived a Cronbach's alpha score for the LKQ that was almost identical to ours at 0.79 [136]. Although Cronbach's alpha values were slightly different across languages, the LKQ had high internal consistency in all existing validation studies from a statistical point of view. For test-retest reliability, the current study obtained an ICC of 0.847, which is similar to the results of 0.8-0.94 in the initial English LKQ [119]. Therefore, the sC-LKQ has high reliability.

The construct validity results showed that the sC-LKQ could be divided into five components instead of the three aspects in the English version [119]. A component analysis of the 16 questions revealed overlapping parts in some topics. According to the results, each of the five categories can be named as follows: specialty medical initiative (Q1-Q5, Q7, Q9, Q11-16), self-processing methods (Q8, Q10), disease manifestation (Q6, Q7), anatomical knowledge and identification (Q1, Q5), and precise LBP definition (Q2). The questions were classified into four categories in a previous study [135]. The influences that lead to these different categorization methods mostly come from differences in cultural and environmental backgrounds. Thus, the sC-LKQ is a comprehensive multidimensional questionnaire that promotes and improves patients'

limited health literacy and health outcomes through improved education and communication strategies [137], [138].

In this study, the average score of sC-LKQ was 14.25±4.42. The scores for the three areas of general knowledge, concepts, and treatment each were 5.45±1.71, 2.17±1.13, and 6.62±2.35, respectively. This result is similar to that previous Chinese LKQ study. The LKQ score was 14.82±4.59 in total, 5.73±1.84 in general knowledge, 2.18±1.23 in concepts, and 6.92±2.28 in treatment [136]. These results corroborate that Chinese people have a low level of knowledge of the concept of LBP. It is worth noting that the participants of the previous study in China were all patients with LBP. In the present study, the LKQ score of LBP patients was 12.33 ± 5.00. The scores of the three corresponding knowledge were 4.56±1.96, 1.92±1.15, and 5.85±2.73, respectively. From this perspective, the LKQ scores of patients with LBP in this study were lower than those reported in a previous Chinese study. This result might be because, in the previous study, the participants were all patients with LBP in tertiary care hospitals in Guangdong Province. People with such medical resources are in China's top economic environment and education [139]. On the contrary, our study did not set a geographic range for the participant population, which is more reflective of the knowledge of Chinese patients with LBP.

The sC-LKQ has acceptable concurrent validity by a strong connection with R-MDQ. Spearman’s rank correlation coefficient showed significant negative correlations between the sC-LKQ and the R-MDQ. This finding was also reported by Kovács-Babócsay et al. [121] who indicated that the poorer the knowledge of spinal health, the more spinal problems occur. Meanwhile, the sC-LKQ score had a significant positive correlation with education level and medical background. This also accords with our earlier observations, which showed that people living in places with superior educational resources have a higher level of knowledge about a specific disease.

Prior studies have also focused on the knowledge of healthcare professionals about LBP (Table 6) [119], [121], [135], [140]. However, the findings from the current study of sC-LKQ in individuals with medical education backgrounds got lower scores. There are several possible explanations for this finding. First, except for the nurses in the study from Kanaan, all other previous studies selected medical personnel closely associated with LBP, such as physical therapists [135]. In our study, not all specialize in spinal health or related fields. It is also reported from Kanaan's study that there were differences in the knowledge of LBP among medical professionals with different orientations [135]. Another possible explanation for this is the differences in sample size. In previous studies, it ranged from 20 to 60, whereas the number of participants in this category in the current study was 164. A larger sample of participants reflects the group's characteristics in a specific setting.

Table 6 The LKQ scores in previous studies among healthcare professionals

Author (year)		LKQ score	General knowledge	Concepts	Treatment
Maciel et al. (2009)		23.55±0.60	8.85±0.36	3.90±0.30	10.80±0.41
Morimoto et al. (2018)		19.1±2.5	8.0±0.8	3.1±0.9	8.0±1.7
Kovács-Babócsay et al. (2019)		19.1	7.8	3.4	7.9
Kanaan et al. (2021)	**Physical therapists**	16.80±2.38	7.05±1.23	2.95±0.83	6.80±1.40
	Nurses	10.85	4.40	1.95	4.50

It is interesting to note that the sC-LKQ scores differed between the Chinese in China and Hungary. The variation in this result is mainly attributed to the differing demographics. Individuals with and without a medical background were included in the analysis. The participants in Hungary were local primarily Chinese students studying there; their overall age was younger, and they lacked LBP knowledge.

This study has several limitations. Although the selection of most participants in China in this study was not geographically limited, the study's participants with LBP in China were primarily from Sichuan Province. They were not fully representative of the entire Chinese population. In addition, the questionnaires were completed online; therefore, errors due to the participants during the filling process could not be avoided.

3.5 Conclusion

The current study showed that the sC-LKQ has sound reliability and validity. It can be used in clinical practice to evaluate the self-efficacy of patients with LBP. In addition, it can be used as a valid evaluation tool in Chinese research on LBP.

Chapter 4 (Sub-study 2)

The effect of Back School intervention on Chinese patients with chronic low back pain

4.1 Introduction

As LBP is a condition that affects all age groups [24]. It has been one of the main factors impacting the years lived with disability throughout the world for the past three decades, and it has a significant negative impact on public health [113]–[115]. Similarly, the long duration and lower pain level associated with chronic LBP make it less noticeable but can affect the quality of daily life.

Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure [141]. It is reported that there is a rise in physical inactivity during the years of college and university, as well as the transition from adolescence to adulthood [142]–[146]. Over the past three years, the massive worldwide epidemic of Covid-19 has added social isolation in life [147]. Lifestyle changes have reduced physical activity and increased sedentary behavior, including university students [148]. Besides, physical activity is one factor influencing the incidence of LBP [149].

European clinical guidelines emphasize the value of exercise and educational treatments to prevent and treat LBP [150]. The BSP is a concept that originated in Sweden in the 1960s [1]. It was later refined by rehabilitation practitioners and medical teams to provide education and rehabilitation services for people with LBP to improve their function and reduce the risk of future attacks [151]. To this day, it has been more than half a century since the BSP was proposed, but studies in different countries and populations continue to proliferate [100], [105], [152]. However, there are no studies

related to Chinese BSP. The purpose of this study was to evaluate the overall situation of Chinese students in Hungary before and after participating in Back School intervention in the post-COVID-19 era, with four dimensions: body performance, knowledge of LBP, PA, and LBP disability

4.2 Material and Methods

4.2.1 Study design and participants

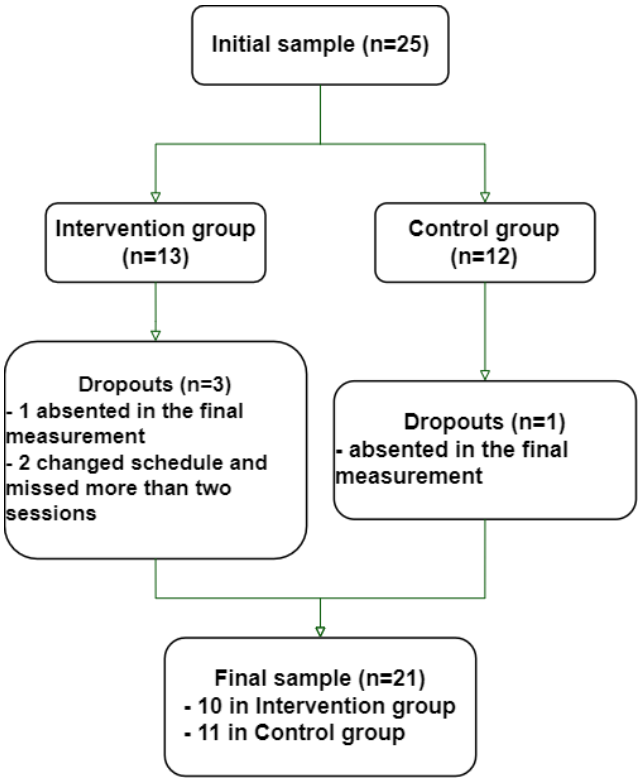

Figure 4 Flowchart of sample selection

This interventional controlled study was conducted at the Faculty of Health Sciences at the University of Pecs in Hungary between July 11, 2022, and November 25, 2022. It was approved by the Institutional Review Board of the Regional Research Committee of the Clinical Center in Pecs (No. 8342-PTE 2020, Appendix 8).

This was a convenience sample study. Participants were recruited through the WeChat social platform by online flies. The following inclusion criteria were applied for the volunteers: (1) reported chronic LBP within the past three months; (2) Chinese who living in Pecs and older than 18 years old; (3) not taking medication or presenting any other musculoskeletal, rheumatic, metabolic, cardiological or neurological disorder; (4) voluntary participation in this study and signing the informed consent. The exclusion criteria are shown below: (1) absenting more than two Back School sessions; (2) missing the measurement sessions; (3) taking medication or showing any other musculoskeletal, rheumatic, metabolic, cardiological, or neurological disorder during the study. Participants chose to join the intervention or control group according to their schedules. There were 25 volunteers at the beginning, and 4 of them drooped. The final number of participants was 21, 10 in the intervention group (IG) and 11 in the control group (CG) (Figure 4). All the participants signed Informed Consent (Appendix 2) before the start of the study and were aware of all possible risks of the study.

4.2.2 Intervention

The study consisted of an intervention based on the BSP, which lasted for eight weeks, with one session per week lasting 90 minutes. The physiotherapists reminded the participants to perform the exercises at home on their own two times a week. The Back School program contains both education and exercise. Additionally, variables were assessed during the original meeting and the final event of the intervention. Table 7 provides an overview of the BSP used in this research.

For the CG, all participants were given a knowledge booklet and exercise advice containing the same contents as IG after the first measurement. And their second measurements were also taken in the eighth week.

Table 7 Summary of Back School intervention

	Theory	Practice
1	Informed Consent and anatomy of the spine	Initial measurements
2	Spine biomechanics, musculoskeletal system, muscle balance, spinal protection	Correct standing position, correct sitting position, feeling the body position
3	Causes of spinal disease, pathomechanism.	Flexibility training, and muscle strengthening exercises in the correct posture. Isometric, isotonic concentric exercise learning.
4	Prevention of spine diseases (within physiotherapy, emphasize active, passive, and alternative forms of movement.). Application of Back School: child, adults.	Correct sitting position and posture training. Muscle strengthening exercises in the correct posture and stretching.
5	Therapeutic options and their short/long-term effectiveness.	Correct four-legged position, posture, and training. Muscle strengthening exercises in the correct posture, and stretching.
6	Spine-friendly lifestyle, ergonomics.	Resistance training of trunk muscles and stretching exercises.
7	Spine protection in daily life; spine protection rules, spine-friendly lifestyle.	Resistance training – trunk muscles; Stretching exercises.
8	Spine protection in the workplace, rules of spine protection, ergonomics, spine-friendly workplace, spine-friendly workstation, and spine-friendly sports and leisure activities.	Obtain participants' measurements at the end of the intervention.

4.2.3 Measurements

All subjects underwent posture measurements on a voluntary basis and with privacy protection, including the line of gravity, a sideline of gravity, stature triangle, shoulder symmetry, and hip symmetry before the intervention. Five manual physical examinations were used to test the physical fitness of all participants before and after

the study containing the McGill trunk flexor test, Biering-Sorensen test, Pectoralis flexibility test, Thomas test, and Straight Leg Raise test.

Participants' core endurance was evaluated using the McGill trunk flexor test and Biering-Sorensen test. These two tests assessed the muscular endurance of the deep flexor and extensor in the core muscles, respectively [153] [154]. The Pectoralis flexibility test aimed to measure the balance of the upper back, which affected the position sometimes [155]. With the Thomas test determines whether hip joint or knee joint muscles are tighter by measuring the length of hip flexors. Other disorders involving psoas syndrome, patellofemoral pain syndrome, LBP, osteoarthritis, and rheumatoid arthritis may have a hip condition that limits the range of motion [156]. The Straight Leg Raise test was to detect the flexibility of hamstrings [157].

4.2.4 Instruments

This study used two LBP-specific questionnaires, one demographic questionnaire, and a physical activity questionnaire.

4.2.4.1 The Low Back Pain Knowledge Questionnaire (LKQ)

The Low Back Pain Knowledge Questionnaire (LKQ) is a standardized assessment tool comprising 16 questions. It is designed to evaluate knowledge pertaining to three key dimensions of LBP, which are general knowledge, concepts, and treatment [119]. The questionnaire has a total score of 24 points. The 16 questions are a combination of eight single-choice and eight double-choice questions, each with five options. Correct responses are scored one point, and a higher overall LKQ score indicates a greater knowledge regarding LBP.

4.2.4.2 The Roland-Morris Disability Questionnaire (R-MDQ)

The Roland-Morris Disability Questionnaire (R-MDQ) was first created in 1983 by Roland and Morris as a self-administered questionnaire for back pain assessment. It

was developed from the Sickness Impact Profile and contains 24 items to evaluate the impact of pain on daily life [129]. The scoring system ranges from zero, indicating no disability, to 24, indicating maximum disability.

4.2.4.3 The Global Physical Activity Questionnaire (GPAQ)

The Global Physical Activity Questionnaire (GPAQ) is a standardized survey developed by the WHO to assess physical activity levels across different populations and countries [158]. The GPAQ has been widely used in research and public health initiatives to estimate physical activity levels and identify physical activity patterns within populations. The questionnaire assesses physical activity across three domains: work-related, transportation-related, and leisure-time physical activity.

4.2.5 Statistic analysis

Statistical analysis was performed using SPSS 25.0 software. The Shapiro-Wilk test was used to verify the normal distribution of the data. Independent samples t-tests were used for between-group comparisons, and paired samples t-tests were used for within-group comparisons. Mann-Whitney U tests were used to assess the results of the intervention and control groups. The relationship between the variables was assessed by Spearman correlation analysis. Results were considered significant at the $p<0.05$ level.

4.3 Results

4.3.1 Baseline data

4.3.1.1 Demographic

Out of the 25 participants included in the study, two were excluded for having missed more than two sessions of Back School in IG. Another two participants absented the final measurement session for personal reasons (one in IG, one in CG). Finally, there

were 21 participants in total recruited for the study. All participants were in tertiary education (undergraduate and above). The demographic data are shown in Table 8. There were any significant differences between IG and CG.

Table 8 Demographic data of participants

Variable	All (n=21)		IG (n=10)		CG (n=11)		P
	$\overline{x} \pm SD$	Median	$\overline{x} \pm SD$	Median	$\overline{x} \pm SD$	Median	value
Age (years)	24.43±2.181	24.00	25.20±2.098	25.00	23.73±2.102	24.00	0.125
Height (cm)	171.10±8.871	172.00	168.80±8.470	170.00	173.18±9.097	172.00	0.269
Body weight (kg)	66.95±13.151	68.00	61.50±12.394	60.00	71.91±12.284	74.00	0.069
BMI (kg/m²)	22.742±3.409	22.833	21.445±3.112	20.963	23.922±3.363	22.840	0.097

$\overline{x}$: mean value; SD: standard deviation; IG: intervention group; CG: control group; BMI: body mass index.

4.3.1.2 Posture examination

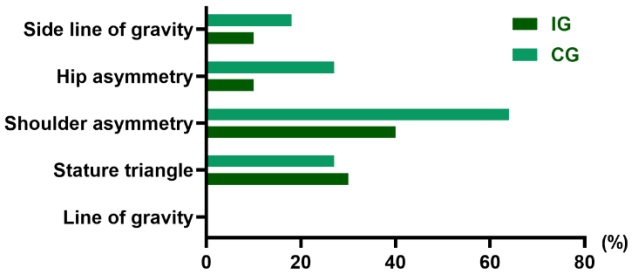

Figure 5 Percentage of participants with impaired posture

In the basic body measurements, all participants confirmed physiologically normal performance in the line of gravity. In the other four morphometry measures, unbalance and asymmetry were observed in both intervention and control groups. Figure 5 shows the number of participants in the two groups with unbalanced and asymmetrical body morphometry as a percentage of the total number of participants in the group individually. Shoulder asymmetry is the most frequently seen abnormal body posture

(IG:40.0%, CG:63.6%), followed by stature triangle and hip asymmetry, respectively (stature triangle: IG: 30.0%, 27.3%; hip: IG: 10.0%, CG:27.3%). Only 10.0% in IG and 18.2% in CG showed impaired position in the sideline of gravity. The results of the Mann-Whitney U test showed no statistical difference in the distribution of their postural morphology levels between the two groups of subjects (Z=-1.102, p=0.270).

Table 9 Results of physical examination and questionnaires before and after the intervention

Variable	Group	Pre-Test		Post-Test		P value	95% CI
		Mean	SD	Mean	SD		
MTFT	**IG**	168.50	74.848	224.70	30.383	0.034 *	[-107.062, -5.338]
(sec)	**CG**	160.82	89.149	158.55	99.333	0.753	[-13.405, 17.951]
BST	**IG**	86.40	50.136	102.20	48.074	0.054	[-31.954, 0.354]
(sec)	**CG**	64.09	20.671	71.45	23.062	0.232	[-20.270, 5.542]
R-MDQ	**IG**	4.40	4.061	2.80	4.392	0.104	[-0.401, 3.601]
	CG	4.36	3.802	5.91	7.981	0.521	[-6.718, 3.627]
LKQ	**IG**	15.90	3.604	19.30	1.703	0.001 *	[-5.024, -1.776]
	CG	15.91	4.826	16.00	2.449	0.961	[-4.104, 3.923]
LKQ-	**IG**	6.10	1.912	7.50	1.179	0.007 *	[-2.305, -0.495]
GK	**CG**	5.82	1.401	5.82	1.250	1.000	[-1.502, 1.502]
LKQ-C	**IG**	2.30	1.059	2.60	0.843	0.279	[-0.889, 0.289]
	CG	2.18	1.328	2.27	0.647	0.846	[-1.108, 0.926]
LKQ-T	**IG**	7.50	1.780	9.20	1.135	0.003 *	[-2.657, -0.743]
	CG	7.91	2.737	7.91	1.300	1.000	[-2.124, 2.124]
GPAQ	**IG**	2764.00	2375.463	2900.00	2916.253	0.905	[-2642.956, 2370.956]
	CG	2695.27	3977.234	2646.18	5218.317	0.918	[-985.026, 1083.208]

CI: confidence interval; SD: standard deviation; MTFT: McGill trunk flexor test; BST: Biering-Sorensen test; R-MDQ: Roland-Morris Disability Questionnaire; LKQ: Low Back Pain Knowledge Questionnaire; LKQ-GK: general knowledge part in LKQ; LKQ-C: concept part in LKQ; LKQ-T: treatment part in LKQ; GPAQ: Global Physical Activity Questionnaire.

4.3.2 Physical examinations

Before the experiment, all the subjects in CG (n=11) showed positive signs in the Pectoralis flexibility test. But none (n=0) was reported for this in IG. 81.8% (n=9) from CG and 40.0% (n=4) were reported positive results in the Thomas test. There were 100% (n=11) participants in CG and 50% (n=5) in IG who observed positive performance for the Straight Leg Raise test. After the intervention, 90.9% (n=10) in CG and 30.0% (n=3) in IG reported positive results in the Pectoralis flexibility test. As for the Thomas test, 81.8% (n=9) of participants in CG and 10.0% (n=1) from IG showed positive signs. And all the participants in CG (n=11) and 20.0% (n=2) in IG got positive results in the Straight Leg Raise test. Statistical differences in pre- and post-intervention outcomes were found in the IG for the McGill trunk flexor test (p=0.034). The results of the physical examination are shown in Table 9.

4.3.3 Questionnaires

In R-MDQ, the mean score of IG was 4.40±4.061 and 4.36±3.802 in CG. Repeated measurements showed that IG decreased to 2.80±4.392, and the CG increased to 5.91±7.981 points.

All the subjects got around 15.9 points (IG: 15.90±3.064, CG: 15.91±4.826) before the Back School intervention in LKQ. After the intervention, there were significant differences between the two groups in LKQ sum score (p=0.001) and two subcomponents: basic knowledge (p=0.007) and treatment (p=0.003). The IG got higher scores than CG. As can be seen from Figure 6 (d), the differences between IG and CG reported in LKQ score (p=0.002) after the test, also in the subpart of LKQ about general knowledge (p=0.005) and treatment (p=0.026).

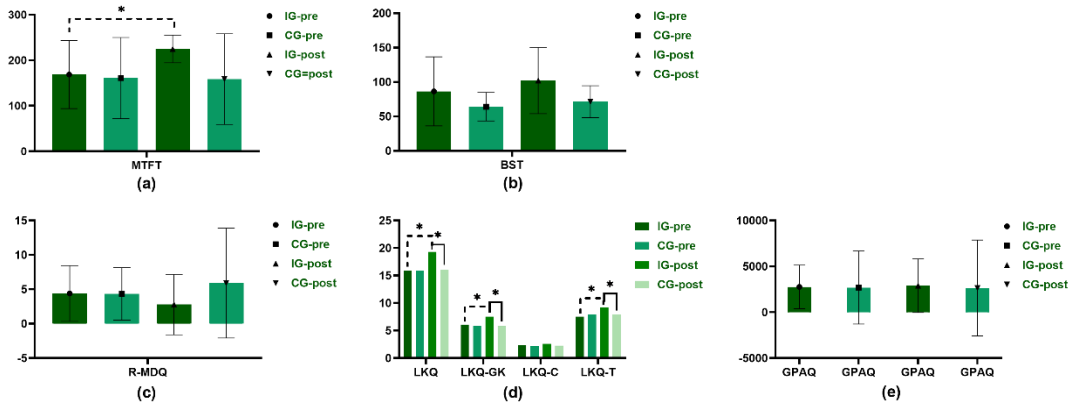

Figure 6 Results and changes between groups in different physical examinations

MTFT: McGill trunk flexor text; BST: Biering-Sorensen test; R-MDQ: Roland-Morris disability questionnaire; LKQ: Low back pain knowledge questionnaire; LKQ-GK: Low back pain knowledge questionnaire-general knowledge; LKQ-C: Low back pain knowledge questionnaire-concepts; LKQ-T: Low back pain knowledge questionnaire treatment; GPAQ: Global physical activity questionnaire; IG: Intervention group; CG: Controlled group.

Table 10 Physical activity patterns of participants in different groups

		IG (n=10)		CG (n=11)		Z	P
		Mean	SD	Mean	SD	value	value
VW	Pre	21.00	49.092	0.00	0.00	-1.520	0.129
(min/week)	Post	18.00	56.921	65.45	217.088	0.000	1.000
MW	Pre	43.00	92.141	76.36	216.484	-0.103	0.918
(min/week)	Post	58.00	122.366	65.45	217.088	-0.578	0.563
Transportation	Pre	124.00	96.056	155.64	189.342	-0.284	0.776
(min/week)	Post	104.00	80.132	152.27	107.107	-1.136	0.256
VR	Pre	154.00	217.010	152.73	227.072	-0.152	0.879
(min/week)	Post	178.00	200.100	94.00	226.124	-1.179	0.238
MR	Pre	174.00	209.083	136.36	234.063	-0.761	0.447
(min/week)	Post	171.00	179.471	124.91	222.641	-0.624	0.533
Sitting	Pre	247.00	154.995	372.73	210.385	-1.421	0.155
(min/day)	Post	234.00	163.041	410.00	283.796	-1.418	0.156

IG: intervention group; CG: controlled group; SD: standard deviation; VW: vigorous-intensity work;

MW: moderate-intensity work; VR: vigorous-intensity recreation; MR: moderate-intensity recreation.

In the physical activity component from GPAQ, all subjects showed no statistically significant differences in physical activity intensity after Mann-Whitney U test results ($p>0.05$), including before and after the intervention (Table 10).

4.3.4 Correlations

In the results of the Spearman correlation analysis, Biering-Sorensen test was found to be associated with McGill trunk flexor test ($r=0.710$, $p<0.001$), vigorous-intensity ($r=0.480$, $p=0.028$) and moderate-intensity ($r=0.484$, $p=0.026$) work hours per week.

4.4 Discussion

The purpose of this study was to determine the effects of a Chinese Back School-based intervention on low back function in patients with chronic LBP. The participants' low back function indicators and questionnaires were used before and after the intervention. This study showed positive effects, including improvements in core muscle strength and flexibility of the hip flexors and hamstrings. Another significant change in the intervention group was reflected in the scores of the LBP knowledge questionnaire, which indicated improvement in participants' understanding of LBP.

In general awareness, both patients, clinicians, and researchers believe that movement and posture are associated with LBP [159]–[161]. This is also reflected in our study. All subjects were patients with chronic LBP and showed impaired posture on examinations.

Trunk muscle strength is one of the factors that influence the incidence of LBP [162], [163]. Strengthening the muscles in the core area is often part of the effective treatment plan adopted by physiotherapists for patients with LBP in clinical practice. In our study,

the increase in trunk flexor strength in the IG demonstrated the effectiveness of the BSP. This result is consistent with the results of the BSP intervention study published in 2021 by Hernandez-Lucas et al. [96]. Coincidentally, trunk extensor strength was also found to be improved in their study but did not show a statistically significant change in ours, although the overall results of the Biering-Sorensen test in the IG group showed a trend towards enhancement. It reminds that the core muscles of the lower back and the hamstrings are noteworthy for their improvement before and after the BSP intervention. This significant change was also reported by Hernandez-Lucas et al [96]. It suggests the embodiment of the kinetic chain in bodywork, especially in musculoskeletal problems, requires attention to the potential influence of tissues adjacent to joints [164].

Self-efficacy is a competency that is applicable in many chronic conditions, including LBP [110]. Patients with high self-efficacy performed better in disease prognosis [112]. As the International Association for the Study of Pain, LBP is an emotional experience that may be impacted by other emotions, such as worry or fear, in addition to being a sensory awareness of physical damage [165]. Thus, it is important to teach patients about the causes and sources of LBP to prevent suffering. The results of the LKQ connect and present these two points very well. After combining theory and exercise training, the IG showed a significant increase in LBP knowledge. This phenomenon demonstrated that the participants were more knowledgeable about LBP disorders, specifically in terms of basic knowledge and treatment. The lack of significant difference in the concept section may be due to confusion in the common perception of the medical terms.

Avoiding strenuous exercise is a sensible form of care for patients with acute LBP. However, in patients with chronic LBP, lack of physical activity may have the opposite effect. According to the physical activity guidelines for the Chinese population published in 2022 [166], our subjects met the fundamental physical activity requirements of 150-300 minutes of moderate-intensity physical activity or 75-150

minutes of vigorous-intensity physical activity per week for Chinese aged 18 years and older. Interestingly, the physical activity data embodied in the population in our study differed from that of a previous Hungarian study, and they found an increase in physical activity among the people after Back School [105]. A possible explanation for this might be due to differences in lifestyle habits considering the culture and age groups of participants. Our study did not show significant differences before and after the intervention due to the smaller sample size and shorter duration of the intervention.

The aim of rehabilitation is to reduce symptoms and pain and to improve function and quality of life. Back School, a professional program focusing on self-management skills, exercise, and education, has shown promise in a number of previous studies to improve the prognosis of back pain patients in many countries. This study found an increase in core muscle strength and low back pain knowledge improvement among Chinese participants. It is meaningful that this program has not been implemented in the Chinese population before.

This study also has some limitations. The small sample size limits the results of this study. Secondly, the 8-week intervention and weekly intervention frequency were insufficient for participants' persistence in the exercise. The self-assessment scale relied on the subject's own report, and bias is difficult to avoid. It would also be interesting to have a follow-up of the study.

4.5 Conclusion

The 8-week Back School intervention was effective in Chinese patients with chronic LBP. It significantly increases the strength of the core muscles. Participants' knowledge of LBP was improved. The Chinese Back School program can be scaled up for use as resources and circumstances permit. Other effects will need to be explored in follow-up studies with large samples.

Chapter 5 (Sub-study 3)

A bibliometric analysis of self-efficacy in low back pain from 1980 to 2021

5.1 Introduction

Low back pain (LBP) is a very prevalent ailment problem that almost everyone will have in their lives [167]. It is the largest cause of years lived with disability [113]. At the same time, LBP poses a greater medical and financial burden worldwide [168], [169]. More attention is urgently required to alleviate the growing strain and its impact on health and social systems [11], [114].

Bandura defined self-efficacy in 1977 as the belief that one can effectively execute a course of action in a particular scenario to create a desired result [106], [109]. In a later study, Bandura suggested that self-efficacy underlies many health-related behaviors and, therefore may be necessary in the area of chronic diseases [170].

Because of the epidemiological elements of LBP, researchers have refined the studies in recent years. While some studies have examined self-efficacy in relation to LBP [109], [110], there are no large-scale bibliometric analyses of self-efficacy for LBP.

Bibliometrics is a quantitative method to analyze data and evaluate research [171]. In numerous multidisciplinary investigations, tracking knowledge dissemination and utilizing cluster analysis can offer a thorough summary [172]–[175]. CiteSpace is a scientific mapping software developed by Chen and his team (Drexel University, Philadelphia, PA, USA) based on a Java language environment background, which can do bibliometric analysis and comparative analysis [176]. It has been used in several disciplines, including regenerative medicine [177], cytology [178], health care [179],

environmental science [180], [181], etc. Based on this, CiteSpace can be used through bibliometrics to explore the specific characteristics of the field.

The purpose of this study was to fill the gaps in current bibliometric studies of LBP self-efficacy by systematically exploring developments, trends, and the current state of the research field between 1980 and 2021. The Web of Science (WOS) database was used as a source for literature analysis to uncover relationships between the literature and to provide more helpful information for future researchers.

5.2 Methods

5.2.1 Data source

All the data of this study were based on the Web of Science Core Collection (WOSCC), including the Social Sciences Citation Index (SSCI), Science Citation Index Expanded (SCI-Expanded), and Emerging Sources Citation Index (ESCI). Literature retrieval was performed in one day (5th January 2022). The search strategy was as follows: TI = (low back pain OR low back ache OR sciatic* OR lower back pain OR lower back ache OR low backache OR backache OR back pain) AND TI = (self manage* OR self-manage* OR self-aware* OR self aware* OR knowledge* OR self control OR self-control OR perception* OR cognitive* OR autogenic OR self-efficacy OR self efficacy OR efficacy OR auto suggestive OR auto-suggestion). The time of publication was limited from 1980 to 2021.

5.2.2 Inclusion and exclusion criteria

The included publications meet the following criteria: (1) the literature topic is LBP; (2) the specific research interests are related to self-management and self-awareness; (3) literature published between 1980 to 2021; (4) literature index from WOSCC, SSCI, SCI-Expanded and ESCI. There were 1155 papers collected on 5th January 2022.

Exclusion criteria: (1) articles not officially published; (2) conference abstracts and proceedings, corrigendum documents. Of these records, the data were cleaned to remove duplicate literature through CiteSpace, resulting in the effective inclusion of 822 publications.

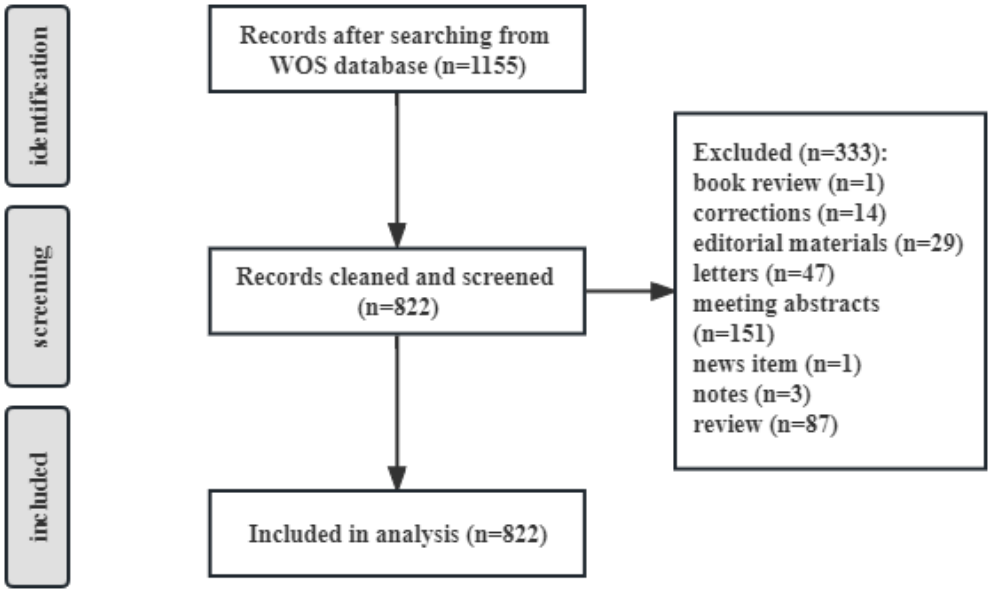

Figure 7 Flow chart of data processing

5.2.3 Analysis tools

There were three software programs used for data organization, analysis, and visualization; CiteSpace 5.8.R3 (Drexel University, Philadelphia, USA), Microsoft Excel 2019, and IBM SPSS 25.0 (SPSS Inc, Chicago, USA). CiteSpace 5.8.R3 is a Java language-based information visualization software built on co-citation analysis theory and pathfinder network scaling. It measures the literature in specific fields, explores key paths and knowledge turning points in the evolution of the subject, and completes the analysis of potential dynamics of subject evolution and detection of subject development frontiers through a series of visual maps [176]. In CiteSpace, the evaluation of the mapping effect by modularity Q value (Q value) and mean silhouette value (S value). When the Q value>0.3, it means that the structure of the divided module

is significant. S value>0.5 indicates that the clustering is reasonable, when S value>0.7, the clustering is considered efficient and convincing [182]. Microsoft Excel 2019 was used for organizing the basic data. IBM SPSS 25.0 was used to conduct correlation analysis in the study.

5.3 Results and Discussion

5.3.1 Analysis of Publication

In 1155 papers, there were 822 references included. Among the records removed were one book review, 14 corrections, 29 editorial materials, 47 letters, 151 meeting abstracts, one news item, three notes, and 87 reviews (Figure 7). Figure 8 shows an upward trend in the number of articles issued each year from a general perspective over the past 41 years. 1980 to 1994 could be seen as the first phase. The overall trend was relatively stable, with little growth. The number of outputs per year was below 10, with the average number of articles published yearly being 3.4. From 1995 to 2008 could be seen as the second phase. It showed fluctuating growth with an average annual publication of 12.286 and declined in the following years (1996, 2000, 2004, 2007). The third phase was from 2009 to 2021, a period of rapid growth, with an average annual volume of 46.08. The number of publications per year was highly significantly and positively correlated with publication year ($r=0.851$, $p<0.001$). The overall publication trend is on the rise, indicating that researchers' interest in self-awareness related to LBP has increased and continues to advance.

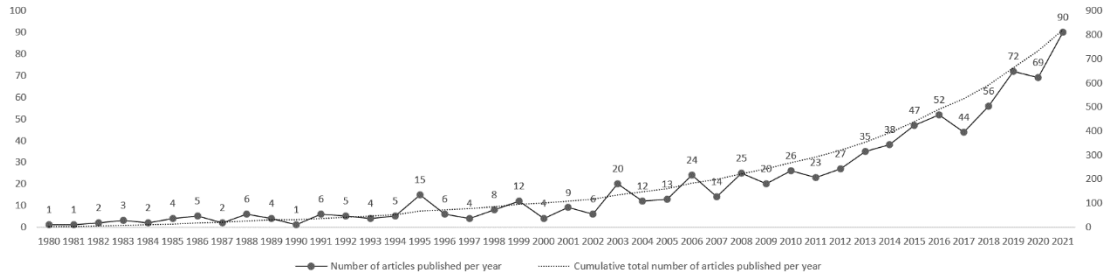

Figure 8 Annual output and cumulative output about LBP of self-efficacy from 1980 to 2021

5.3.2 Analysis of Countries and Institutions

There were 103 regions identified in citing countries through CiteSpace. The top 5 most cited countries were the United States of America (USA, n=181), England (n=76), Australia (n=71), Germany (n=61), and Netherlands (n=38). Followed by the Republic of China, Italy, South Korea, and Ireland. In CiteSpace, sigma is a combination of a structural attribute (mediated centrality) and a temporal attribute (burstiness), with higher sigma values indicating higher impact potential [182]. The USA had the highest Sigma score (290.49). Germany (7.7) and England (1.04) were the second and third, others were equal to 1. Meanwhile, in Figure 9, the USA has the most connected lines with other countries, indicating the most intensive collaboration in LBP self-efficacy research. Taken together, in the field of LBP self-efficacy research, the USA holds the largest volume, works closely with other countries, and this trend will continue due to its impact potential.

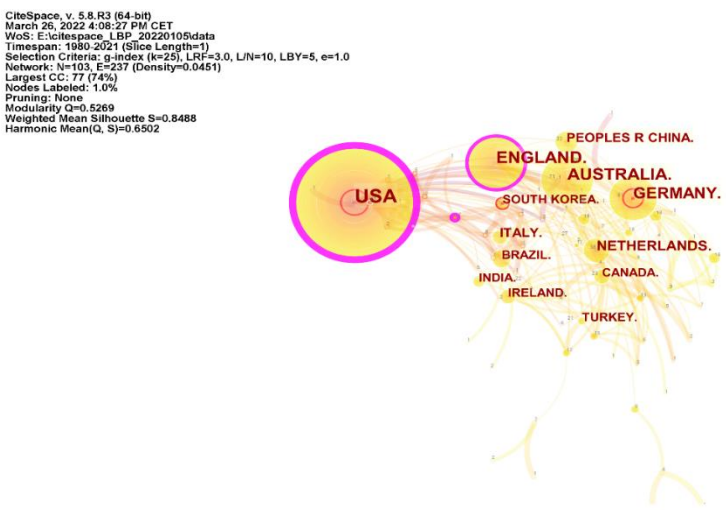

Figure 9 Mapping of cooperation networks between countries

Each node represents a country, and the lines linked between clusters indicate the cooperation relationship between countries (the thicker the line, the stronger the cooperation; the redder the color of the line, the earlier the year, and the more yellow shows closer to the present). Every circle inside represents publications in one year. Purple circles show the publication with high betweenness centrality, which is the key point to link two different research areas.

The visualization map was generated by the collaborating organization in Figure 10, with significant modularity and silhouette scores (Q=0.9155, S=0.9686). A total of 604 institutions were identified. Curtin University (n=26), University of Sydney (n=13), and University of Limerick (n=9) were the top 3 by citation counts. There were four organizations with the same citation counts 8 followed (the Haukeland Hospital, Oxford University, the University of Washington, and Harvard University). It shows a more dispersed distribution of study power in LBP self-efficacy. Nevertheless, the top 5 affiliations ranked by centrality were Curtin University, the University of Sydney, Harvard University, Maastricht University, and Erasmus University. In Figure 10, bursts were only found at Curtin University in 2012 and at the University of Sydney in 2015. In summary, Curtin University and the University of Sydney are in an important role in the development of this field. In the meantime, our cluster analysis based on the keywords revealed that the largest cluster was Cluster #0, with the label physiotherapy. The top 3 institutions by citation counts all belonged to Cluster #0. This suggests that the intersection of physiotherapy and LBP self-management is a pivotal part of the discipline.

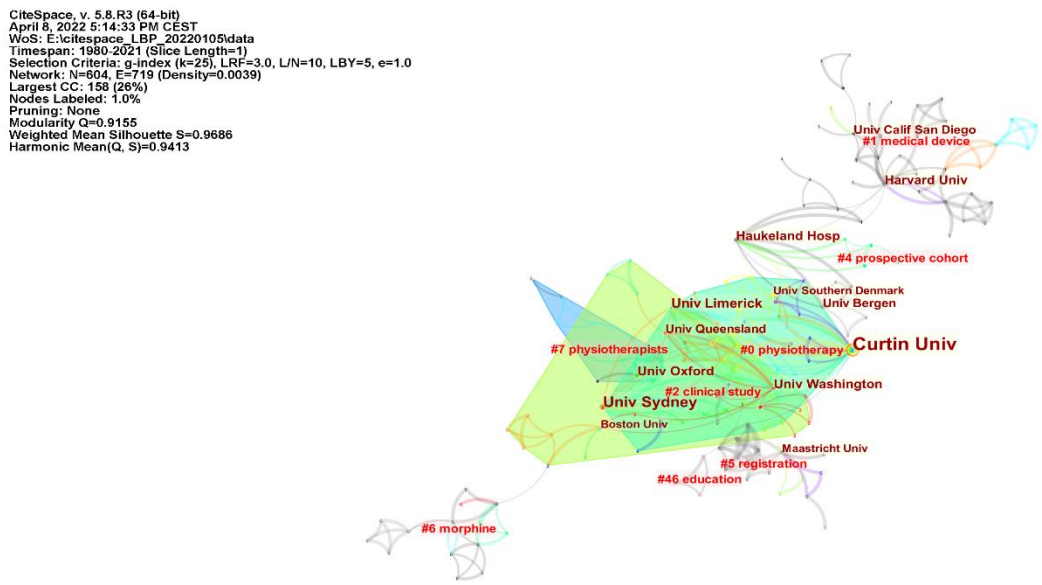

Figure 10 Visualization map of collaborating organizations

Different color blocks represent the clusters with different labels through the keywords from

publications. Each node shows one institution. The line between each node indicates the emergence of a cooperative relationship between institutions (colored lines represent more recent years, black and gray lines represent earlier years).

5.3.3 Analysis of subject categories

Every article belongs to one or more subject categories. After co-occurrence analysis, there were 93 WOS categories in 815 papers (Figure 11). Neurosciences & Neurology had the highest number of articles (215 records, 26.380%), accounting for a quarter of the total. Following were clinical neurology (197 records, 24.172%), rehabilitation (155 records, 19.018%), orthopedics (154 records, 18.896%), and general & internal medicine (121 records, 14.770%). This network was divided into seven co-citation clusters. The largest cluster (#0) had 19 members, which was efficient and convincing (S>0.7, S=0.888). Among the top five disciplines in terms of number, the first, second, and fourth-ranked disciplines all belong to cluster #0, and the average publication year is 1995.

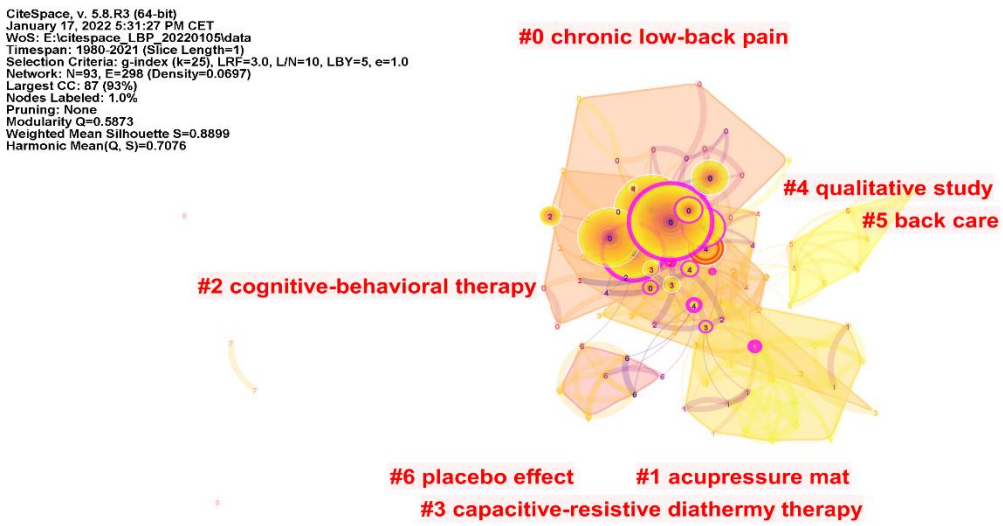

Figure 11 Subject categories co-occurrence map of LBP self-efficacy

In the development of subject categories, five subjects had citation bursts in 1980-2021 (Figure 12), which belonged to Cluster #2 and Cluster #4. The top two and the fourth

subject categories with the strongest citation bursts belonged to Cluster #2, labeled as cognitive-behavioral therapy. This suggests that researchers have been linking LBP with cognitive-behavioral therapy since 1981, and the focus has been popular for more than 20 years. Medicine, general & internal was the third burst subject belonging to Cluster #4, qualitative study. It was the most recent burst happening from 2019 and may continue in the future. Nursing was the fifth burst subject, also belonging to Cluster #4. Its bursts only lasted for two years, but still have high burst strength. It demonstrated the importance placed on qualitative research as a research method in the discipline of nursing.

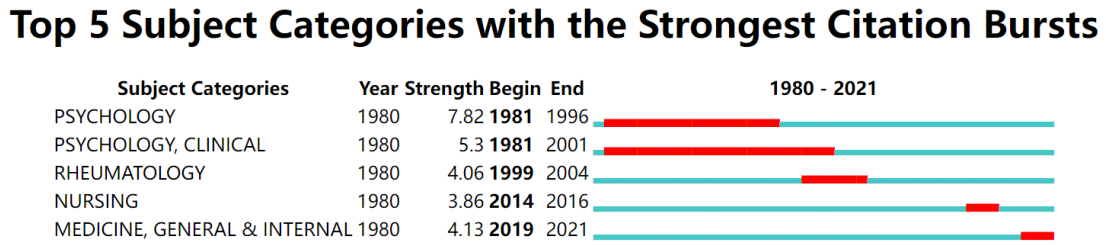

Figure 12 Top 5 subject categories with strongest citation bursts with LBP self-efficacy

5.3.4 Analysis of Journals

All references were published in 330 different journals. The top 5 journals with the most publications were: *Spine* (n=50), *BMC Musculoskeletal Disorders* (n=29), *Pain* (n=29), *Journal of Back and Musculoskeletal Rehabilitation* (n=20), and *Pain Medicine* (n=20).

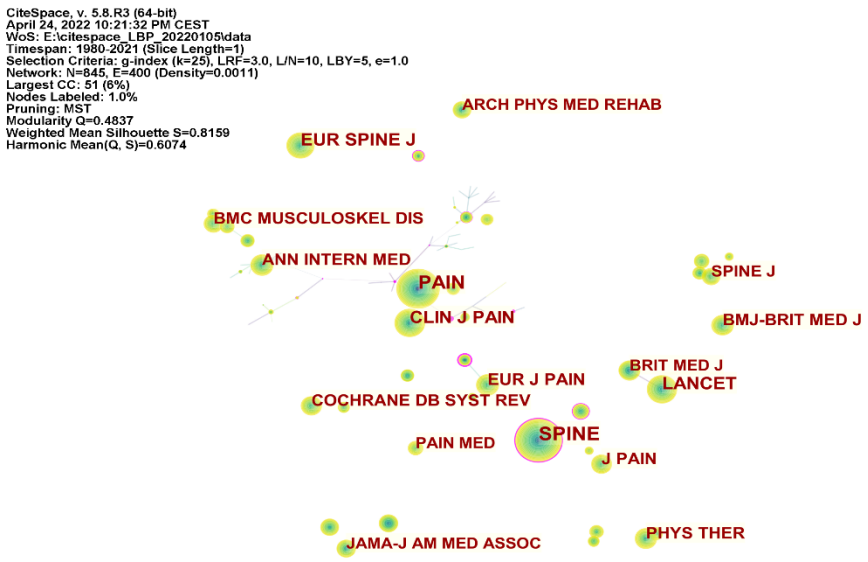

Figure 13 The minimum spanning tree of journal co-citation network

Table 11 Top 10 journals with high co-citation counts

Ranking	Cited journal	Co-citation counts	IF (2020)
1	*Spine*	594	3.468
2	*Pain*	543	6.961
3	*European Spine Journal*	304	3.134
4	*Lancet*	296	79.323
5	*Clinical Journal of Pain*	284	3.442
6	*European Journal of Pain*	243	3.934
7	*Annals of Internal Medicine*	210	25.391
8	*Physical Therapy*	207	3.140
9	*Cochrane Database of Systematic Reviews*	205	9.289
10	*Journal of Pain*	198	5.828

IF: impact factor.

The top 10 co-cited journals are listed in Table 11, and the network map of co-citation journals is shown in Figure 13. The top 5 co-cited journals were: *Spine* (citation counts=594), *Pain* (citation counts=543), *European Spine Journal* (citation counts=304), *Lancet* (citation counts=296), and *Clinical Journal of Pain* (citation counts=284). The highest cited publication was "Reduction of Pain Catastrophizing Mediates the Outcome of Both Physical and Cognitive-Behavioral Treatment in Chronic Low Back Pain", for 394 times before 2022 in the *Journal of Pain*. This research demonstrated that pain catastrophizing could be reduced by therapy aspects that do not specifically target in cognitive issues and that pain catastrophizing was one of the important factors mediating functional activity in patients with chronic LBP [183]. "Randomized clinical trial of lumbar instrumented fusion and cognitive intervention and exercises in patients with chronic low back pain and disc degeneration" was the most cited reference in *Spine*, and the second among all 380 times, which suggested the usage of multidisciplinary rehabilitation for chronic LBP especially in cognitive intervention and exercise [184].

Among the publications and co-cited analysis, *Spine* and *Pain* were the core journals in the field of LBP self-efficacy.

5.3.5 Analysis of Authors

The scientific mapping of the published article's authors and cited authors were presented in Figure 14**,** showing the collaboration between authors and identifying the important authors in the field. The most prolific author was Peter O'Sullivan, with 13 publications, followed by Kieran O'Sullivan and Anne Smith, with 11 and 6 publications separately. In co-cited authors, Waddell G was the one who had the highest co-cited counts of 155 times, Deyo RA (147) was the second, and Roland M (130) was the third, followed by Chou R and Linton SJ (Table 12). On the centrality of co-cited authors, there were four authors with high centrality. Deyo RA had maximum centrality (0.24), followed by Waddell G (0.18), Turk DC (0.11), and Bandura A (0.10). The

amount to which a node in a network was part of pathways that connected an arbitrary pair of nodes in the network was measured by centrality [176]. It indicated that these four authors were influential in developing research that derived LBP self-efficacy from other disciplines.

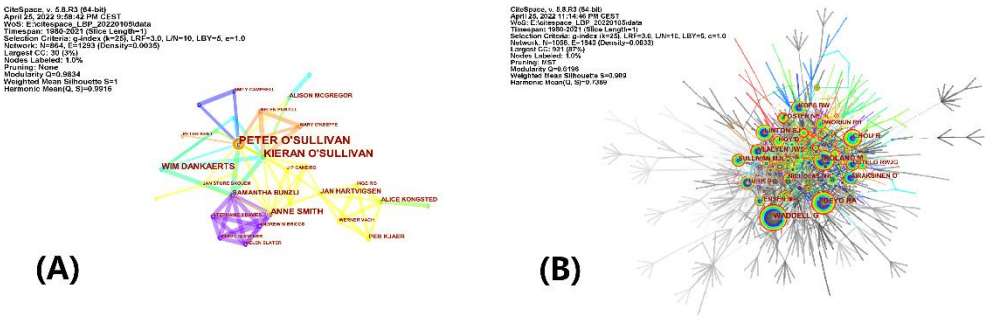

Figure 14 Scientific mapping of authors and co-cited authors

(A) Collaborative network among authors in LBP self-efficacy. (B) Co-cited authors network in LBP self-efficacy.

Table 12 Top 10 authors ranked by number of papers in first author, the first 10 co-cited authors ranked by co-citation number

Author	Published papers	Co-cited authors	Co-cited counts
Peter O'Sullivan	13	Waddell G	155
Kieran O'Sullivan	11	Deyo RA	147
Anne Smith	6	Roland M	130
Wim Dankaerts	6	Chou R	111
Christopher GM	5	Linton SJ	96
Amanda MH	5	Vlaeyen JWS	90
Melissa AD	4	Airaksinen O	81
Dawn ME	4	Koes BW	79
Jan Hartvigsen	4	Turk DC	75
Aage Indahl	4	Jensen MP	75

Peter O'Sullivan studying cognitive functional therapy, especially with non-specific chronic LBP, was the most prolific author in LBP self-efficacy. His highest-cited paper was a qualitative study using the semi-structured interview of physiotherapists' perceptions after cognitive functional therapy training. In this study, physiotherapists showed confidence in the biopsychosocial dimensions of chronic LBP after cognitive functional therapy training [185]. Cognitive functional therapy is a unique, comprehensive, patient-centered strategy that analyzes and regulates cognitive, psychological, and social aspects that are thought to be obstacles to healing in persistent LBP [160], [186]. Previous studies have focused more on the effect of self-efficacy on the course of disease in patients with LBP, but this study extended the effect of perception to physiotherapists. Cognitive functional therapy is an expression of the progression of self-management from an evaluation tool to the application of treatment. This phenomenon was evidence of the development of multidisciplinary crossover. As the second most prolific author in this research area, Kieran O'Sullivan was also one of the co-authors of this paper.

Table 13 Top 10 papers with the maximum citation counts in LBP self-efficacy

Title	First author	Journal	Impact factor	Year	Citation
Noninvasive treatments for acute, subacute, and chronic low back pain: a clinical practice guideline from the American college of physicians	Qaseem A	*Annals of Internal Medicine*	25.391	2017	34

Prevention and treatment of low back pain: evidence, challenges, and promising directions	Foster NE	*Lancet*	79.323	2018	34
What low back pain is and why we need to pay attention	Hartvigsen J	*Lancet*	79.323	2018	25
Non-specific low back pain	Maher C	*Lancet*	79.323	2017	25
A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain	Van Middelkoop M	*European Spine Journal*	3.134	2011	17
Chapter 4. European guidelines for the management of chronic nonspecific low back pain	Airaksinen O	*European Spine Journal*	3.134	2006	15
A systematic review of the global prevalence of low back pain	Holy D	*Arthritis And Rheumatism*	8.955	2012	14
Behavioral treatment for chronic low-back pain	Henschke N	*Cochrane Database of*	9.289	2010	144

		Systematic Reviews			
The global burden of low back pain: estimates from the Global Burden of Disease 2010 study	Hoy D	*Annals of the Rheumatic Diseases*	19.103	2014	14
Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010	Vos T	*Lancet*	79.323	2012	13

5.3.6 Analysis of References

The top 10 papers with the maximum citation counts are shown in Table 13. There are guidelines, medical devices, and systematic reviews among these ten papers. In terms of publication years, the earliest of them was published in 2006 (16 years ago). Taken together, it indicates that in this period, scholars valued the combination of evidence-based and practical and relied on a higher quality of evidence. Meanwhile, the literature with a high burst (red circles in Figure 15) were also these ten articles. The timeline map (Figure 15) shows the top 12 clusters. Using index terms, all clusters were labeled from the typical characteristics of references. “Chronic low back pain”, “posture”, and “evidence-based management” were marked as the three largest clusters. The biggest cluster reflected current research interest in persistent LBP. Prior to this, studies concentrated on evidence-based therapy and postural control as themes connected to LBP self-management. As the timeline graph changes, it becomes clear that research

focusing on LBP self-management has grown in popularity since 2000.

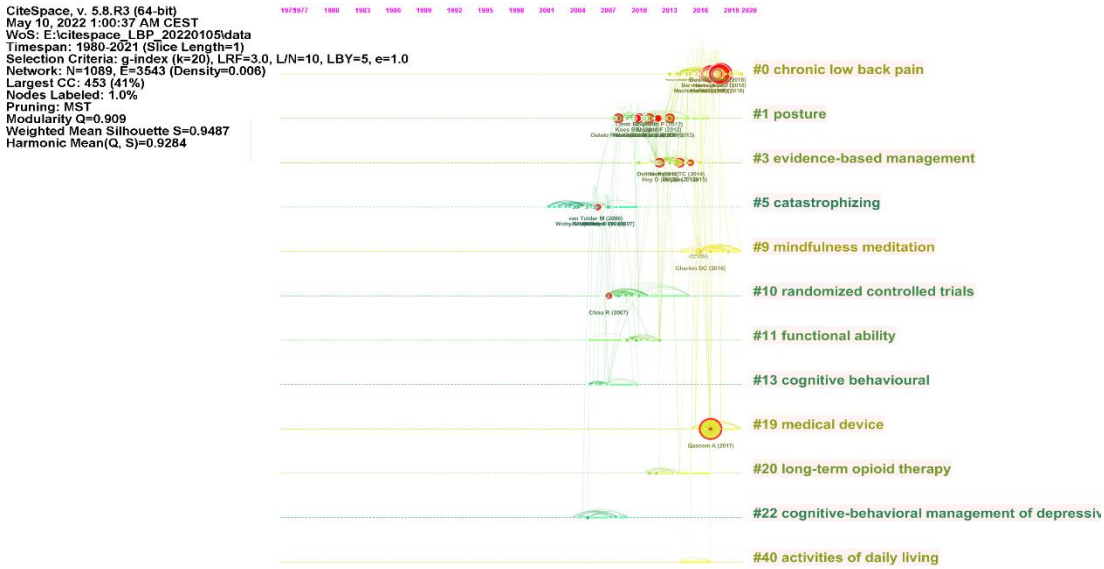

Figure 15 Timeline view of co-cited references about LBP self-efficacy

5.3.7 Analysis of Terms and Keywords

The key words co-occurrence map was generated by CiteSpace with 640 nodes (Figure 16). The top keyword was low back pain, followed by disability, management, chronic low back pain, primary care, questionnaire, clinical trial, back pain, randomized controlled trial, and therapy. Therefore, the focus of current research in this area can be summarized in the following aspects: method, primary care, and back pain.

(1) Method: clinical trials, mainly randomized controlled trials, are often used to determine the effectiveness of an intervention or to compare which approach is more successful. Different types of disability functional rating questionnaires serve as important evaluation indicators in research [36], [184], [186].

(2) Primary care: primary care is the first step before treatment begins. In LBP, a cognitive-behavioral program enhances self-care [187]. Educational intervention programs combined with exercise also benefit primary care and self-management[188], [189].

(3) Back pain: it contains acute LBP, non-specific LBP, upper back pain, and LBP. In

the treatment process, the value of self-efficacy and cognitive function therapy for persistent LBP is still being contested [186], [190]. Pain relief through pharmacological intervention therapy is helpful in chronic LBP [191], [192].

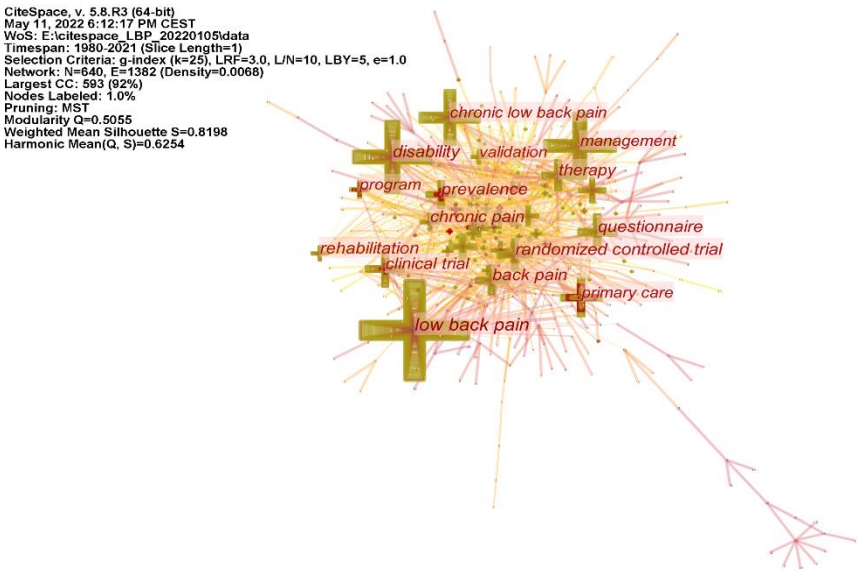

Figure 16 Key words cluster map in LBP self-efficacy

Figure 17 shows the top 16 keywords with the highest burst strength through time. It indicates the term that had received more attention in each year's time slice, reflecting the emergent focus on the term in the field of study over a period.

In terms of the timing of the bursts about keywords, the scope of research has gradually refined over the past 20 years, from a focus on trial and primary care, through a brief period of psychological factors related to the theme of "fear avoidance", to these years' hotspot on specific populations among older adults and intervention in behavioral manifestations of cognitive. Meanwhile, older adults, cognitive behavioral therapy, people, guidelines, and reliability would be potential forefronts in LBP self-efficacy research over the coming years.

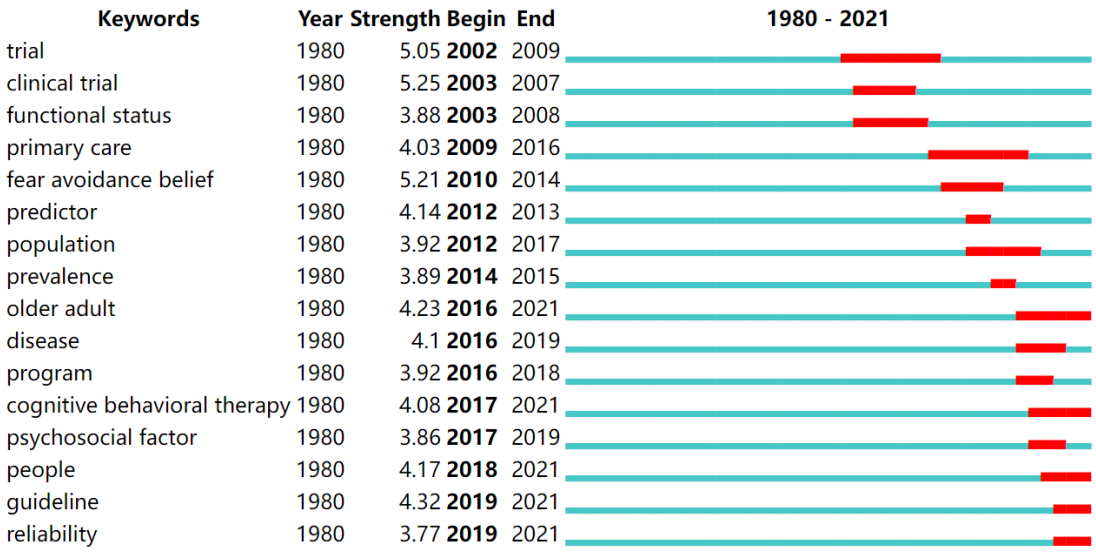

Figure 17 Top 16 keywords with the highest burst strength

Sorted according to the length of the burst time from longest to shortest.

Although this study is the first to examine multiple aspects of bibliometric self-efficacy for LBP over the past 40 years, it still has limitations. First, for inclusion in the database, only WOS was used, despite it being recognized as one of the most important data sources in bibliometric analysis. Furthermore, while current research has been able to provide a comprehensive science mapping of the state in research on LBP self-efficacy, there are still functions to be discovered in CiteSpace software to have more in-depth integration. As CiteSpace is also a Java language-based software, there may be inevitable errors in the screening mechanisms and calculations due to the algorithm during the software analysis.

5.4 Conclusion

This is the first bibliometric analysis study about self-efficacy in LBP from 1980 to 2021. From this research, we can assess the status and development of the field of LBP self-efficacy over the past 41 years. Publications on self-management and self-efficacy for LBP have been rising linearly and will continue to expand. The USA held significant dominance in this research area. It was the largest publication volume country, followed

by England, Australia, and Germany. There was also close cooperation in universities and institutions between European countries and American. From the disciplinary point of view, it mainly involved neurosciences, rehabilitation, and orthopedics. General & internal medicine may continue to burst in the following years. *Spine* was the most recognized journal, had high co-citation counts, and provided a good communication platform for relevant research. It was noteworthy that there were numerous researchers involved, but even the authors with the highest number of publications did not publish a large number of articles. At the same time, the lack of collaborative communication between authors might be because of the different specific research directions, for instance, cognitive behavioral therapy, knowledge interventions, and others. In terms of detailed research methods and content, clinical trials were the main way used for most of the studies. Cognitive behavioral therapy in specific groups of people, especially in elders, might be the frontiers and trends of future research related to LBP self-efficacy.

This study provides insight into the whole process of LBP self-efficacy over the past four decades. It gives researchers a basis for potential collaborations with other authors and institutions and guides publication platform selection. Hot spots and trends within the field are predicted.

Chapter 6 Discussion and Limitations

This dissertation is a study that takes the LKQ as a starting point and focuses on quantitative research methods with three sub-studies. From the validation of the reliability of the appropriate measurement tool to the application of specific rehabilitation interventions, then it derives a scientific summary and outlook on the topic of self-efficacy in LBP. The first sub-study performed Beaton's guidelines for the process of cross-cultural adaptation of self-report to obtain the sC-LKQ. It involved questionnaire distribution among Chinese in China and Hungary to validate the reliability and validity of sC-LKQ, demonstrating that it has good reliability and validity. The sC-LKQ can be used in clinical practice and research targeting Chinese individuals. The second sub-study was an 8-week intervention in which Chinese adult individuals with cLBP participated in BSP, with their posture, physical performance, sC-LKQ, and GPAQ as measurement standards to observe changes before and after the intervention. This study found that the BSP was also an effective intervention for cLBP in Chinese. It improved the strength of core muscle groups and the knowledge of LBP. The third sub-study was the first article to explore the bibliometric analysis of self-efficacy for LBP. Literature metrology analysis was performed on self-efficacy publications for LBP from electronic databases from 1980 to 2021, quantifying the scientific research development in LBP self-efficacy over the past 41 years. The research volume in this area has shown linear growth and will continue to rise. Research on LBP self-efficacy will continue to stand out in general and internal medicine in the coming years. And the combination of self-efficacy for LBP with cognitive behavioral therapy for the elderly will become the forefront of such a domain in the future.

In view of the fact that the results of each sub-study have been explored separately in previous chapters, the main focus of this chapter is to discuss the findings between the sub-studies.

Firstly, all three sub-studies were conducted on the topic of LBP. The sC-LKQ was used

as the main tool in sub-study one and two. Sub-study one demonstrated the reliability and validity of the sC-LKQ, which was then applied in the rehabilitation intervention study in Chinese BSP. The LKQ is a self-assessment tool that reflects the participants' mastery of knowledge about LBP. It can be used as a professional and objective tool to measure their self-efficacy, specifically in LBP. In today's inevitable sedentary behavior, self-efficacy directly impacts the management of chronic pain and subsequently affects LBP prognosis.

Both the sC-LKQ and BSP are helpful in gaining a comprehensive understanding of LBP. The questionnaire helps individuals identify their knowledge gaps and provides targeted information for therapists. BSP is a practical tool for the education, prevention, and management of LBP. When used together, these methods can improve individuals' understanding of LBP, enabling them to make informed decisions about their own health and potentially reduce the risk of future episodes. For therapists, this approach allows for more personalized treatment plans and needs assessment, improving efficiency and accuracy.

Not only in the understanding of LBP but also in its management, there are new insights. The identification of knowledge gaps through sC-LKQ is crucial because it allows individuals to make informed decisions about their care and actively participate in treatment plans. With increased knowledge, individuals are more likely to follow evidence-based practices, adhere to treatment recommendations, and engage in self-management strategies for back pain. BSP also emphasizes lifestyle changes such as maintaining a healthy weight, engaging in regular PA, and managing stress, all contributing to back health. At the same time, combining the sC-LKQ with BSP empowers individuals by providing them with the specific knowledge and skills to actively manage their LBP. This supports the individual to control their condition better, thus increasing confidence and self-efficacy in managing their symptoms. When individuals understand the rationale behind a particular intervention or lifestyle change,

they are more likely to adhere to the prescribed treatment, resulting in better outcomes. It also improves compliance with the treatment phase.

The current research focuses on the intervention of BSP for Chinese people. The sC-LKQ, which had been validated, was used as one of the tools to measure the effectiveness of BSP. The duration, method, and content of BS also affect the results of the sC-LKQ. Our research results in this area are consistent with the Hungarian BS study [105]. However, whether in the validation study or the BSP intervention, we found that the baseline score of the sC-LKQ for Chinese people was better than that of most countries [119], [120]. As for the reason, we speculate that there are several possible factors: (1) Traditional Chinese Medicine (TCM): TCM has a long history in China and emphasizes holistic approaches to healthcare. It includes practices such as acupuncture, herbal medicine, and therapeutic exercises like tai chi and qigong [193], [194], which can involve back pain prevention and management. Exposure to TCM concepts may provide Chinese individuals with a broader understanding of LBP and its treatments. (2) Cultural practice: in traditional Chinese cultural customs, not only Tai Chi and Qigong but also martial arts, Wuqinxi, and other forms of physical exercises are all part of the constitution of therapeutic exercise. For Chinese people, these physical exercises that shape the body are introduced at a very young age and reflect people's attention to health awareness, posture, and demeanor. (3) Cultural attitudes toward seeking healthcare: the attitude towards seeking healthcare is generally positive due to the widespread coverage of public healthcare institutions and basic medical insurance. Compared to other countries, the speed of seeking medical attention is much faster in China. Although the fact that many hospitals in China do not operate on an appointment basis may increase the burden on the hospital's daily patient numbers, it has also influenced patients to be more aware of disease-related knowledge and to actively seek medical treatment. In our research, this situation has led to higher scores for LKQ compared to other countries. However, we have also found that in the specific conceptual aspect, people were still prone to confusing symptoms of LBP with other

neural-related diseases. This is also a drawback of popularizing general medical knowledge.

There are three main types of LBP scales and questionnaires used in clinical practice in China, namely pain assessment scales (Numeric Pain Rating Scale, Visual Analogue Scale, Faces Pain Scale, and the Chinese Fear-Avoidance Beliefs questionnaire), low back motor dysfunction assessment measurement scales (the Chinese version of Oswestry disability index, simplified Chinese functional rating index, Quebec back pain disability scale and Chinese version of R-MDQ), and 36-Item Short Form Survey for assessing the functional status [195]. Therefore, there is no measurement tool similar to the sC-LKQ in Chinese clinical practice, and while the use of the Fear-Avoidance Beliefs questionnaire reflects pain avoidance beliefs and self-efficacy to some extent, the sC-LKQ is a more visual representation of where the specific LBP knowledge is lacking. At the same time, this is another weakness in the Chinese rehabilitation system, which is the poor focus on prognosis and follow-up for LBP patients.

In the current research, we have found that BSP-based intervention for LBP is a rehabilitative approach that can improve the core muscle strength and knowledge of LBP among Chinese participants. However, we have observed no similar specific programs in China's LBP rehabilitation and medical practices. The Expert Consensus on Diagnosis and Treatment of Acute/Chronic Nonspecific LBP in China, published in 2016 by the Spinal Cord Committee of the Chinese Association of Rehabilitation Medicine, mainly considers medication, surgery, exercise therapy, and physical therapy for the treatment and rehabilitation [196]. But the updated Clinical Guidelines for Nonspecific LBP in China in 2022 have added LBP education and self-management without further elaboration on specific content [197]. Comparatively speaking, there is a significant gap between Europe and China in managing LBP. While Europe had already established specialized knowledge and movement interventions like BSP for

LBP in the 1960s, it is only in recent years that China has emphasized the importance of self-management and disease knowledge education in the guidelines. This makes it possible that there is no practical application of rehabilitation similar to BSP in China. Several factors could explain this observation: firstly, as discussed in this section, there is a lack of awareness of the educational component of knowledge in LBP rehabilitation in treatment policies. Secondly, China's healthcare system is complex and fragmented, with differences in resources, infrastructure, and priorities in different regions. This fragmentation can lead to inconsistent access to rehabilitation services and difficulties in standardizing programs for managing LBP. Furthermore, emphasizing acute care in China's healthcare and rehabilitation may have fewer resources allocated to most cLBP. Similarly, the lack of a rehabilitation workforce can hinder the development of programs such as BSP. Due to China's large population base, healthcare finance, funding, and equipment availability are all challenges to further promoting rehabilitation programs. There are also two sides to the impact of TCM mentioned before, one of the negative effects is that more people may rely on TCM treatments and have limited acceptance of evidence-based rehabilitation.

In the three sub-studies, the limitations of each have been specifically discussed. In the overall research framework, the main limitation of this study is reflected in the sample size of the BPS. Due to the limitations of the research location and time, our main subjects were Chinese international students at Pecs, which is not a large group, and there were not many people who met the inclusion criteria. In addition, some participants dropped out for personal reasons or due to time constraints, further reducing the number of participants. Similarly, the population participating in our BSP intervention was from Hungary, which may lead to biased results if applied to China. Not conducting follow-up research is also a limitation. If there are follow-ups after three months, six months, or one year, it will provide a better understanding of whether BSP has a long-term impact.

Chapter 7 Conclusion and Further Considerations

7.1 Conclusion

The sC-LKQ can be used as a self-assessment tool to assess participants' knowledge of LBP. It can be used in the prevention and treatment of LBP. The BSP, a rehabilitation education combined with exercise practice intervention, is also applicable to the Chinese population and can improve the participatory performance of core muscles. However, there is still a need for further standardization of the specific intervention components of the BSP in China. The topic of LBP self-efficacy has received a high level of attention over the past 40 years. It is likely to continue to develop in the future, particularly in the areas of cognitive behavioral therapy and in relation to elderly people.

7.2 Clinical implications

(1) The sC-LKQ can be used in clinical practice to rehabilitate LBP in China. It is applicable not only in hospitals but also in rehabilitation clinics. It is a valid evaluation tool to identify gaps in patients' knowledge, resulting in a more targeted rehabilitation program and increasing patients' awareness of the causes, treatment, and basic concepts of LBP. Not only from the therapist's perspective but also from the patient's perspective, the questionnaire can be used several times during the rehabilitation process to monitor changes in the level of knowledge of LBP, to assess the effectiveness of current interventions, and to dynamically change the rehabilitation program.

(2) The BSP model and methodology could be tried and replicated in China for adults after standardizing the guidelines. As a knowledge education combined with an exercise therapy intervention model, the BSP can improve participants' knowledge of LBP, help individuals make clear judgments about their condition, and adopt self-management strategies and preventive measures. At the same time, enhanced self-management can

also improve pain control and function, potentially reducing the need for medical intervention. Since most current BSP programs include ergonomics, LBP-friendly lifestyle, and functional training parts, the implementation of BSP can improve participants' low back strength performance and physical status, and thus improve low back functional outcomes and prevent pain recurrence. BSP is also an intervention that moves patients from passive treatment to active participation, in which participants can be empowered with individual rights and increase their motivation for rehabilitation. Given these clinical applications, its extra potential impact is to enable a good prognosis for patients with LBP, reduce the number of medical interventions, and save healthcare costs.

(3) The bibliometric analysis of LBP self-efficacy over the past 41 years also has multiple clinical implications. First, influential authors were identified, allowing clinical therapists to use this precise information to access groundbreaking research advances. Second, the study can serve as a reference for selecting effective interventions in clinical practice, identifying gaps in current practice and research, clarifying the direction of future research, and guiding the development of new approaches to LBP interventions.

7.3 Suggestion for further research

(1) Due to the limited sample size and characteristics, it is recommended that future studies with higher levels of evidence and larger sample sizes demonstrate the effectiveness of BSP in China.

(2) Considering the changes in physiological factors and different age groups, studies could be differentiated by age levels and personalized to adjust the content of BSP.

(3) For the clinical practice of BSP nationwide in China, it is advised that a BSP rehabilitation intervention guideline should also be improved to make BSP modular, considering the average economic level and rehabilitation resources available.

Chapter 8 Summary of Novel Findings

- Sub-study one:
    1. After adherence to the Beaton cross-cultural study and pretesting, the sC-LKQ was readable for Chinese people.
    2. The sC-LKQ showed acceptable internal consistency and a high construct validity level within five components: specialty medical initiative, self-processing methods, disease manifestation, anatomical knowledge and identification, and precise LBP definition. It presented strong concurrent validity with R-MDQ, which was negatively correlated with each other.
    3. Results reflected in the sC-LKQ found that Chinese people had slightly higher knowledge of LBP than populations in other countries. The categorization of questions in the questionnaire showed that there is still room for improvement in the LBP concepts section.

- Sub-study two:
    1. The 8-week-long rehabilitation education combined with exercise therapy BSP intervention was effective for Chinese people with cLBP in Hungary. This intervention model significantly improved participants' knowledge of LBP and core muscle performance.
    2. Although the BSP intervention model was effective for Chinese people in Hungary, however, its dissemination and application in China needs to take into account the resources and realities of healthcare environments in different regions.

- Sub-study three:
    1. It was the first time to examine multiple aspects of bibliometric self-efficacy for LBP over the past 41 years and provided insight into the whole process within the topic.
    2. LBP self-efficacy has seen a linear increase in attention over the past 41 years

and is still growing, especially in the USA, England, Australia, Germany, and the Netherlands, leading the top five in the number of articles published in the field. There was closer cooperation between universities and institutions in Europe and America.

3. From the disciplinary point of view, it mainly involved neurosciences, rehabilitation, and orthopedics. General & internal medicine may continue to burst in the following years. Cognitive behavioral therapy in specific groups of people, especially in elders, might be the frontiers and trends of future research related to LBP self-efficacy.

Acknowledgment

First of all, please allow me to give my biggest thanks to my mother, Congrong Tang. I've always been a person who doesn't let my family worry about me and is very independent. However, while studying in a new country, there were so many difficulties and hardships. Especially the pandemic, during which I was here alone for more than 1000 days and nights. It coincided with my mom's retirement, so she had more energy to care about my life and listen to me. If without her encouragement, support, and spiritual companionship during these years, I think it would have been tough for me to preserve on this path of academics until this moment. It seems that no amount of words can express the complex and deep emotions inside. I am also grateful to my dad Pengfei Wang and my relatives. Living in another country has made me feel the preciousness of family love more than ever.

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List of Publications and Scientific Activities

Published full-text articles related to the dissertation

Márta H; Melinda J; Viktória P; Zsolt J S; Pongrác Á; Brigitta S; **Zhe W**; Alexandra M.
Disease-Specific Knowledge, Physical Activity, and Physical Functioning Examination among Patients with Chronic Non-Specific Low Back Pain.
INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC HEALTH, 19: 19 Paper: 12024, 9 p. (2022)
DOI: 10.3390/ijerph191912024
Impact factor: 4.614

Zhe W; Klára S; Alexandra M; Melinda J.
A bibliometric analysis of self-efficacy in low back pain from 1980 to 2021.
PAIN PRACTICE, 23: 4 pp. 378-389., 12 p. (2023)
DOI: 10.1111/papr.13201
Impact factor: 3.079

Zhe W; Yinyao X; Olivia D J; Alexandra M; Melinda J.
Adaption and Validation of Simplified Chinese Version of the Low Back Pain Knowledge Questionnaire (sC-LKQ)
FRONTIERS IN PUBLIC HEALTH, 11 Paper: 1232700, 7 p. (2023)
DOI: 10.3389/fpubh.2023.1232700
Impact factor: 5.2

Zhe W; Alexandra M; Dorina E C; Nikolett I T; Kinga B; Melinda J.
The Effect of Back School Intervention on Chinese Patients with Chronic Low Back Pain
HEALTH PROBLEMS OF CIVILIZATION, 17: 1 p. 1, 41 p. (2023)
DOI: 10.5114/hpc.2023.131868
Impact factor: 0.4

Abstracts related to the dissertation

Zhe W; Yinyao X; Dorina C; Nikolett I T; Alexandra M; Melinda J.

Characteristics and Differences in Disease-specific Knowledge of Chinese and Hungarian Low Back Pain Patients and Healthy Adults.

8th International Conference of the Universitaria Consortium "Education for Health and Performance": Book of Abstracts

Cluj, Kolozsvár, Romania: Editura Risoprint (2022) 87 p. pp. 86-86., 1 p.

Zhe W, Yinyao X, Alexandra M, Nikolett T, Balint M, Boncz I, Melinda J.

Differences in Low Back Pain Knowledge Between Cultures: The Instance of Chinese and Hungarian Adults.

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Vienna, Austria: Value in Health (2022) 25(12): S494.

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Budapest, Hungary: Association of Hungarian Ph.D. and DLA Students (2020) 600 p. pp. 514-514., 1 p.

Zhe W; Jian C; Alexandra M; Melinda J.

Characteristics of Lower Extremity Muscle Electromechanical Delay During Amateur Athletes After ACL Reconstruction.

27th Annual Congress of the EUROPEAN COLLEGE OF SPORT SCIENCE

Köln, Germany: European College of Sport Science (2022) p. 513

Book chapters

Jian C; Wei L; **Zhe W**. (Translator)

Therapeutic Exercise: Moving toward function （治疗性运动提升功能）

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Appendix

Appendix 1 Information for participants

参与者须知

“八周腰背康复干预对在匈中国人影响的研究”

(The impact of an 8-week Back School intervention on Chinese people in Hungary)

地点：佩奇大学·健康科学学院·物理治疗及体育科学研究所

项目主管：Dr. Jaromi Melinda, Dr. Makai Alexandra

研究员：王哲

腰背康复“Back School”是一项在欧洲临床物理治疗中广泛应用的项目。它旨在通过对有下腰痛的人群进行干预，提高他们对该症状的自我管理意识，增加对下腰痛病症的理解，改善预后。但是，该项目尚未广泛在中国人中开展。本研究的目的是探究该腰背康复项目在中国人中的有效性，并期望能增进下腰痛人群对疾病的自我意识和自我管理。

如果您对该项目有任何疑问，请随时联系我们。

联系人：王哲

微信：janewaiting8023

电子邮箱：wangzhe.zora1129@gmail.com

如果您同意参与此项目，请填写之后的《参与者知情同意书》。项目开始后，您有权在项目进行中随时无理由退出。

Appendix 2 Informed Consent

参与者知情同意书

八周腰背康复干预对在匈中国人影响的研究

地点：佩奇大学·健康科学学院·物理治疗及体育科学研究所
研究员：王哲（佩奇大学·健康科学学院博士学校）
邮箱： wangzhe.zora1129@gmail.com，微信：janewaiting8023

姓名：…… …….
出生日期及点：…… ……

我已阅读并知晓所附信息，对此无任何其他疑问。我同意将我的个人信息用于研究，整个参与过程都出于自愿。我可以在任何时候改变我的意愿，且无需给出任何理由。我已知晓，参与这项研究项目没有任何经济牵扯和补偿。

通过签署本知情同意书，再次声明，我同意使用我的个人数据，包括与我的身体或精神健康有关的部分，以及其他个人资料。

签署后，我将收到一份《参与者须知》和《参与者知情同意书》的副本。

…… ……
日期 参与者签名

受理人签名 研究员签名

八周腰背康复干预对在匈中国人影响的研究

地点：佩奇大学·健康科学学院·物理治疗及体育科学研究所

研究员：王哲（佩奇大学·健康科学学院博士学校）

邮箱： wangzhe.zora1129@gmail.com，微信：janewaiting8023

我们诚邀您参加这项临床研究。在您做决定前，请仔细阅读以下信息，这将帮助您了解该研究的研究目的、研究内容、如何使用您的数据、可能的益处、风险及其他不便之处。在您签字前，请仔细阅读，如果您对该研究有任何疑问，请联系工作人员。

研究目的

这项研究将通过仪器测试和问卷调查，以评估参与者的腰痛情况。由此获得的数据包括疼痛级别、个人生活质量及其他个人信息，所有数据仅用于科学研究。

该项目是否具有强制性？

参加该项目完全出于参与者的自我意愿。如果您参与其中，您不会有任何损失。在您决定参与后，将要求您签署这份《知情同意书》。在项目进行中，您可以以口头或书面形式随时改变您的参与意愿，且不需要其他额外说明。

同意参与后需要做什么？

您只需遵循研究员提出的与研究相关的安排。

参与该项目对我有什么益处？

您将得到专业且免费的与下腰痛相关的物理治疗评估，更全面了解自己的脊柱健康，对下腰痛有进一步的认识，提高自我生活质量。

参与该项目的过程中我是否需要支付其他开销?

该项目全程免费。

我的个人信息将会被如何使用?

签署知情文件后，表示您同意在研究期间收集到的您的个人信息将被用于科学研究。所有数据将严格按照《数据保护法》的规定进行处理，我们也有责任确保您的个人数据不会落入未经授权的其他人员手中。

如果您对该研究有任何疑问，请联系我们的工作人员。

…….……..…… ……..

研究人员签字及日期 受试者签字

Appendix 3 Examination sheet

项目测试表

Examination sheet

1. 个人信息 Personal Data:

姓名 Name: .....

性别 Sex: 男 male / 女 female

年龄 Age: .....

身高 Height:..... cm

体重 Body Weight: ..... kg

BMI（暂时不填）:.....

是否曾患有下腰痛？Have you ever had Low Back Pain? 是 yes / 否 no

什么时候开始？至今持续多久？When?.....

是否接受过针对下腰痛的治疗？Have you ever got therapy for your LBP? 是 yes/ 否 no

如果是，接受治疗的种类是什么？Therapy: .....

是否接受过脊柱健康相关的针对性训练或教育（健康护理、体育运动及康复）？

Have you ever participated in any spine training or education (health care, sport, or rehabilitation)?

是 yes / 否 no

接受训练/治疗/康复的时长大约是多少小时？How many hours did it take? ……小时 h

是否被确诊过其他与脊柱生长发育相关的疾病？（休门氏病，脊柱侧弯等）

Have you ever been diagnosed with any childhood spine disease (Scheuermann, scoliosis, etc.)?

是 yes / 否 no

2. 实验室检查 Special tests:

屈肌耐力测试 McGill test:.....sec

下腰部伸肌等长耐力测试 Biering-Sorensen test:.....sec

胸大肌柔韧性测试 Pectoralis flexibility test: positive / negative

髋关节屈肌柔韧性测试 Hip flexors flexibility test: positive / negative

膝关节屈肌柔韧性测试 Knee flexors flexibility test: positive /negative

3. 姿势评估 Posture examination

放松休息位姿势 Habitual:

正面观 Front:

重力线 Line of gravity: physiological/not physiological

身体三角 Stature triangle: symmetrical/asymmetrical

双肩对称性 Shoulder symmetry: symmetrical/asymmetrical

髋关节对称性 Hip symmetry: symmetrical/asymmetrical

侧面观 Side:

重力线 Line of gravity: physiological/not physiological

问卷填写

4. **Roland-Morris Disability Questionnaire (Chinese)**

5. **Low Back Pain Knowledge Questionnaire (Chinese)**

6. **GPAQ questionnaire (Chinese)**

Appendix 4 Back School movement training diagram

第一阶段（Phase 1)

动作示意图 Movements	动作要领及注意事项 Notes
	**正确的坐姿 Sitting position** 双眼平视前方，控制颈部不要过分向前或向后。双肩自然下沉，双手放在大腿上。 双腿分开约一个大腿的宽度。躯干与大腿自然呈 90 度角，大腿与小腿呈 90 度角。 Keep your eyes flat in front of you and control your neck not to go too far forward or backward. Keep your shoulders naturally down and place your hands on your thighs. Spread your legs about a thigh's width apart. The torso is naturally at a 90-degree angle to the thighs, and the thighs are at a 90-degree angle to the calves.
	**正确的站姿 Standing position** 直立，双眼平视前方，控制颈部不过分前倾和后缩。尽量使双耳耳垂与肩胛骨在同一平面。双肩打开手臂下垂，掌心向内。 双腿自然分开，想像在头部上方有一根线向上垂直提着躯体。 练习动作： 原地前后换重心：站立位，双脚不要翘起或踮脚，完成重心由前脚掌缓慢移动到脚跟再到前脚掌的过程，躯体可随重心改变轻微先前及向后移动，保持腹部前后侧（核心区）肌肉收紧。 Stand upright, eyes flat in front of you, and control your neck so that it is not excessively tilted forward and retracted. Try to keep your earlobes in the same plane as your shoulder blades. Open your shoulders and lower your arms, palms inward. Spread your legs naturally and visualize a line above your head, lifting your torso vertically upwards. Practice the movement: In place before and after the center of gravity: standing position, feet do not tiptoe or tiptoe, to complete the center of gravity from the forefoot slowly moving to the heel and then to the forefoot of the process, the torso can be changed with the center of gravity slightly before and after the backward movement, to maintain the front

动作示意图 Movements	动作要领及注意事项 Notes
	and back side of the abdominal muscles (core area) tightened.
	**仰卧核心区等长收缩训练（1）** **Supine core isometric contraction training (1)** 仰卧，单侧下肢屈髋屈膝，双臂自然放在身体两侧，掌心向上。 练习时保持下腰部（核心区）肌肉向地面用力，使核心区、肩部、手背紧贴地面。持续用力 8-10 秒为一次。左右侧下肢分别屈曲进行练习。 Lie on your back, bend the hip and knee of one side of the lower limb, and place your arms naturally on both sides of your body, palms up. Exercise to keep the lower lumbar (core area) muscles toward the ground forces so that the core area, shoulders, and the back of the hand are close to the ground. Keep exerting force for 8-10 seconds at a time. Right and left side lower limbs are flexed separately for the exercise.
	**仰卧核心区等长收缩训练（2）** **Supine core isometric contraction training (2)** 仰卧，双下肢屈髋屈膝，双脚及双膝之间约一个髋关节的宽度，双臂放在身体两侧，双臂、头部呈向下的 V 型，掌心向上。 练习时保持下腰部（核心区）、肩部、手背紧贴地面，持续用力 8-10 秒为一次。 Lie on your back with both lower limbs flexed at the hip and knee, about a hip's width between the feet and knees, arms on both sides of the body, arms, and head in a downward V-shape, palms up. Keep the lower back (core area), shoulders, and back of the hands close to the ground during the exercise, and continue to exert yourself for 8-10 seconds at a time.
	**仰卧核心区等长收缩训练（3）** **Supine core isometric contraction training (3)** 仰卧，双下肢屈髋屈膝，双臂伸直与躯干呈 90 度，掌心向上。 练习时保持下腰部（核心区）、肩部、手背紧贴地面，持续用力 8-10 秒为一次。 Lie on your back with both lower limbs flexed at the hips and knees, arms straight, and torso at 90 degrees, palms up. Exercise to keep the lower back (core area), shoulders,

动作示意图 Movements	动作要领及注意事项 Notes
	and back of the hands close to the ground, with continuous force for 8-10 seconds for once.
	**仰卧核心区等长收缩训练（4）** **Supine core isometric contraction training (4)** 仰卧，双下肢屈髋屈膝，双臂伸直与躯干呈 90 度，手掌垂直立于地面（小拇指一侧贴于地面）。 练习时保持下腰部（核心区）、肩部、手掌侧缘紧贴地面，持续用力 8-10 秒为一次。 Lie on your back, bend both lower limbs at the hips and knees, straighten your arms at 90 degrees to your torso, and stand with your palms vertically on the ground (with the side of your little thumbs on the ground). Exercise to keep the lower back (core area), shoulders, and palm side edge close to the ground, with continuous force for 8-10 seconds for once.
	**仰卧核心区等长收缩训练（5）** **Supine core isometric contraction training (5)** 仰卧，双下肢屈髋屈膝，双臂伸直与躯干呈 90 度，手掌掌心向下。 练习时保持下腰部（核心区）、肩部、掌心紧贴地面，持续用力 8-10 秒为一次。 Lie on your back with both lower limbs flexed at the hips and knees, arms straight, and torso at 90 degrees, palms down. Exercise to keep the lower back (core area), shoulders, and palms close to the ground, with continuous force for 8-10 seconds once.
	**仰卧核心区等长收缩训练（6）** **Supine core isometric contraction training (6)** 仰卧，双下肢屈髋屈膝，双臂于躯干呈 90 度，小臂与大臂呈 90 度（即一个类似 W 的动作），掌心向上。 练习时保持下腰部（核心区）、肩部、手背紧贴地面，持续用力 8-10 秒为一次。 Lie on your back, bend your knees at the hip with both lower limbs, arms at 90 degrees to the torso and lower arms at 90 degrees to the upper arms (i.e., a W-like movement), palms up. Exercise to keep the lower back (core area), shoulders, and the back of the hands close to the ground, with continuous force for 8-10 seconds for once.

动作示意图 Movements	动作要领及注意事项 Notes
	**仰卧核心区等长收缩训练（7）** **Supine core isometric contraction training (7)** 仰卧，双下肢屈髋屈膝，双臂向上呈一个 V 型，掌心向上。 练习时保持下腰部（核心区）、肩部、手背紧贴地面，持续用力 8-10 秒为一次。 Lie on your back with both lower limbs flexed at the hips and knees, arms up in a V-shape, palms up. Keep the lower back (core area), shoulders, and back of the hands close to the ground during the exercise, and continue to exert yourself for 8-10 seconds at a time.
	**仰卧核心区等长收缩训练（8）** **Supine core isometric contraction training (8)** 仰卧，双下肢屈髋屈膝，双臂向上伸直尽量靠近双耳，掌心向上。 练习时保持下腰部（核心区）、肩部、手背紧贴地面，持续用力 8-10 秒为一次。 Lie on your back with both lower limbs flexed at the hips and knees, arms straight upward as close as possible to both ears, palms up. Exercise to keep the lower back (core area), shoulders, and the back of the hands close to the ground, and continue to exert force for 8-10 seconds once.
	**仰卧核心区等长收缩训练（9）** **Supine core isometric contraction training (9)** 仰卧，双下肢屈髋屈膝，双手放在约后脑勺下方的位置。 练习时保持下腰部（核心区）、肩部、手肘紧贴地面，持续用力 8-10 秒为一次。 Lie on your back with both lower limbs flexed at the hips and knees, and place your hands approximately below the back of your head. Keep your lower back (core area), shoulders, and elbows close to the floor during the exercise, and continue to exert yourself for 8-10 seconds at a time.
	**仰卧核心区等长收缩训练（10）** **Supine core isometric contraction training (10)** 仰卧，双下肢屈髋屈膝，双手放在颅顶上方。 练习时保持下腰部（核心区）、肩部、手肘紧贴地面，持续用力 8-10 秒为一次 Lie on your back with both lower limbs flexed at the hips and knees and hands placed above the top of the skull.

动作示意图 Movements	动作要领及注意事项 Notes
	Keep the lower back (core area), shoulders, and elbows close to the ground during the exercise, and continue to exert force for 8-10 seconds once

第二阶段（Phase 2)

动作示意图 Movements	动作要领及注意事项 Notes
	**仰卧直腿抬高** **Supine Straight Leg Raise** 仰卧，手心朝上放于身体两侧，单腿屈髋屈膝。另一条腿伸直缓慢抬起至足部高度约与对侧膝关节等高，保持3-5 秒后放下。 腰腹、肩背后侧持续用力，尝试保持头部后侧贴地的情况下，下颌（下巴）略微后缩（双下巴）姿势。 Lie on your back with your palms facing up on either side of your body and bend one leg at the hip and knee. Slowly lift the other leg straight up to the height of the foot approximately equal to the opposite knee, hold for 3-5 seconds, and then lower. With continued force behind the lower back and shoulders, try to maintain a slightly retracted jaw (double chin) position with the back side of the head on the ground.
	**仰卧屈膝抬腿** **Supine Bent Knee Leg Raise** 仰卧，双手上举（如图，称 baby position）。单侧腿屈髋屈膝。另一侧腿伸直，缓慢抬腿屈膝至与对侧膝关节等高，再在空中将抬起的腿伸直，缓慢放下。 Lie on your back with your hands up (as shown, call it baby position). Bend one leg at the hip and knee. With the other leg straight, slowly raise the leg and bend the knee to the level of the opposite knee, then straighten the raised leg in the air and slowly lower it.
	**俯卧抬腿** **Prone leg raise** 俯卧，尽量保持额头贴地，双手置于身体两侧，分别缓慢抬起两侧下肢（如：右腿抬起-放下，左腿抬起-放下）。 Lie prone, keeping your forehead on the floor as much as possible, place your hands on either side of your body, and slowly lift each lower leg (e.g., right leg up-down, left leg up-down).

动作示意图 Movements	动作要领及注意事项 Notes
	**俯卧四肢交替抬起** **Prone alternating limb raises** 俯卧，双手向前伸过头顶置于地面。 **动作一：** 抬起右手-抬起左手-抬起右腿-抬起左腿-放下右手-放下左手-放下右腿-放下左腿 **动作二：** 抬起右手-抬起左腿-抬起左手-抬起右腿-放下右手-放下左腿-放下左手-放下右腿。 Lie prone with your arms stretched forward over your head on the floor. Movement one: Raise right hand - Raise left hand - Raise right leg - Raise left leg - Lower right hand - Lower left hand - Lower right leg - Lower left leg Movement two: Raise right hand - Raise left leg - Raise left hand - Raise right leg - Lower right hand - Lower left leg - Lower left hand - Lower right leg.
	**俯卧 baby position 抬四肢** **Prone baby position lifting** 俯卧，肘关节屈曲（baby position）。与上一组动作一样，可先抬起上肢再抬下肢，也可交替抬起。 Lie prone with the elbow flexed (baby position). As with the previous set, you can lift the upper limb and then the lower limb, or you can alternate lifting.
	**俯卧双手抱头抬四肢** **Lying on your abdomen with your hands on your head and lifting your limbs** 俯卧，双手置于后脑勺，手肘放于地面，与之前的动作一样，分别抬起单侧上肢-对侧下肢-对侧上肢-同侧下肢，再逐一放下。 Lie prone, hands on the back of the head, elbows on the floor, and as before, lift the unilateral upper limb - contralateral lower limb - contralateral upper limb - ipsilateral lower limb, and then lower them one by one.
	**背部牵拉** **Back streching** 跪姿，坐在自己的小腿及脚上。躯干及上肢逐渐趴在地面，双手尽可能向前向远伸，静态保持 30 秒。 In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper limbs on the floor, reaching your

动作示意图 Movements	动作要领及注意事项 Notes
	arms as far forward and as far away as possible, and hold static for 30 seconds.
	**胸肌牵拉** **Pectoral stretching** 站在门框/墙壁一侧。一侧手的上臂及肘关节贴于平面拐角侧的一面，伸手的同侧下肢向前迈一步，身体以肘关节、向前伸的角为支点，缓慢转动躯干向对侧，感受抬手一侧胸肌的牵拉。 更改手臂与墙面的角度（手掌向上、向下放），同样的动作，分别牵拉胸肌的上束和下束。 Stand on the side of the door frame/wall. With the upper arm and elbow joint of one hand on the corner side of the plane, take a step forward with the lower leg on the same side of the reaching hand, and with the elbow joint, the corner of the reaching forward, as the fulcrum of the body, slowly rotate the torso to the opposite side and feel the pull on the pectoral muscles on the side of the lifting hand. Change the angle of the arm to the wall (palm up, down), the same action, respectively, pulling the upper and lower bundles of the pectoral muscles.

第三阶段（Phase 3)

动作示意图 Movements	动作要领及注意事项 Notes
	**仰卧直腿抬高** **Supine Straight Leg Raise** 仰卧于地面，双手自然下垂放在身体两侧。一侧腿屈髋屈膝，缓慢抬起另一侧腿至约 90°，保持 3-5 秒后，缓慢放下，换另一侧。 动作过程中，保持身体躯干的控制能力，核心区、肩部、手肘向地面持续用力。 Lie on your back on the floor with your hands naturally down on either side of your body. Bend one leg at the hip and knee, slowly lift the other leg to about 90°, hold for 3-5 seconds, then slowly lower and switch to the other side. Maintain control of the torso during the movement, with continuous force from the core, shoulders, and elbows toward the ground.

动作示意图 Movements	动作要领及注意事项 Notes
 	**仰卧贴地推手臂** **Lying on your back and pushing your arms against the ground** 仰卧，屈髋屈膝上举双臂贴地（baby position）。上臂与肩膀平齐，核心区及肩背部后侧向地面用力，收紧。 缓慢向上推双臂，至双臂完全伸直，再缓慢还原至起始位。 （想像自己站在一面墙壁前，感受身体用力的同时，完成推手臂的动作。） Lying on your back, bend your hips and knees to raise your arms to the ground (baby position). Keep your upper arms level with your shoulders and tighten your core and the back of your shoulders toward the ground. Slowly push your arms upward until they are fully extended, then slowly return them to the starting position. (Imagine yourself standing in front of a wall and feeling your body pushing as you complete the arms push.)
	**俯卧交替抬腿** **Prone alternating leg raises** 俯卧地面，双手放于身体两侧。大腿不动，缓慢抬起一侧小腿，保持 3-5 秒，缓慢放下，换另一侧继续。 感受核心区和大腿部位的持续用力。 Lie down on the ground with your hands on either side of your body. Without moving your thighs, slowly lift your calf on one side, hold for 3-5 seconds, slowly lower, switch to the other side, and continue. Feel the sustained exertion in the core and thigh area.
	**仰卧空中双脚相对** **Lie on your back with your feet facing each other in the air** 该动作为一系列训练的起始动作。 仰卧，双手放在身体两侧。分别举起两侧双腿至空中，脚掌相对并保持。 动作过程中，保证下腰部及核心区完全贴地，避免腰部形成“桥梁式”空隙。 This movement is the starting movement for a series of exercises. Lie on your back with your hands on either side of your body. Raise each leg into the air, keeping the feet opposite each other. During the movement, make sure that your lower back and core are completely on the ground, avoiding the formation of a "bridge" gap in the lower back.

动作示意图 Movements	动作要领及注意事项 Notes
	**仰卧空中双脚相对变式 1** **Supine raising feet in the air variation 1** 以仰卧空中双脚相对作为动作起始。 上肢呈现 baby position，感受骨盆打开，核心区用力，背部及肩胛骨用力，手臂用力。 Start the movement by lying on your back with your feet facing each other in the air. The upper body is in baby position, feeling the pelvis open, the core hard, the back and shoulder blades hard, and the arms hard.
	**仰卧空中双脚相对变式 2** **Supine raising feet in the air variation 2** 以仰卧空中双脚相对变式 1 作为动作起始。 一侧下肢保持起始位，另一侧下肢尝试缓慢伸直，但不接触地面，收回，继续对侧。 Start the movement with Supine raising feet in the air variation 1. One lower limb stays in the starting position while the other attempts to slowly straighten without touching the floor, retract, and continue on the opposite side.
	**仰卧空中双脚相对变式 3** **Supine raising feet in the air variation 3** 下肢为仰卧空中双脚相对，双臂向空中伸直。 缓慢放下一侧上肢的同时，缓慢伸直对侧下肢（如，右手缓慢放下至地面，左腿同时缓慢伸直但不接触地面），缓慢收回，换对侧。 动作过程中，注意腰部紧贴地面用力。 The lower limbs are supine in the air with the feet opposite each other and the arms straightened into the air. Slowly lower one side of the upper limb at the same time, and slowly straighten the opposite side of the lower limb (for example, the right hand slowly lowered to the ground, the left leg at the same time slowly straighten but do not touch the ground), slowly retracted, change the opposite side. During the movement, pay attention to the waist close to the ground force.
	**正确的四点支撑** **Correct four-point brace** 由于是双手掌、双膝起重点支撑的职能，所以称为“四点支撑”四点支撑是维持和衡量核心区肌肉及身体双侧肌肉平衡程度的基本动作之一。 动作如图。 需要注意，正确的四点支撑动作中，小腿与大腿呈九十度，大腿与躯干呈九十度，双臂与身体呈九十度。头颈不要过度屈伸

动作示意图 Movements	动作要领及注意事项 Notes
	（即不要仰头或抬头），尽量保持颈椎与躯干形成一条直线。 It is called the "four-point brace" because both palms and knees play a key supporting function. The four-point brace is one of the basic movements for maintaining and measuring the balance of the muscles of the core and the muscles on both sides of the body. The movement is shown in the picture. It is important to note that in a correct four-point brace, the calves are at ninety degrees to the thighs, the thighs are at ninety degrees to the torso, and the arms are at ninety degrees to the body. The head and neck should not be hyper-flexed (i.e., don't tilt your head back or raise your head), and try to keep the cervical spine in a straight line with the torso.
	**四点支撑初级平衡训练** **Primary Balance Training with Four-Point Support** 在四点支撑的基础上，减少一个支撑点，变成“三点支撑”，维持身体其他部位的动作模式不变。 以四点支撑为起始动作，抬起一侧手臂，向前伸，使手臂与躯干平齐，在同一平面。保持 5 秒左右，缓慢放下，换对侧。 动作过程中，保持核心区的控制能力。 In a four-point brace, reduce the number of support points by one to a "three-point brace," keeping the rest of the body in the same movement pattern. Starting with a four-point brace, lift one arm and extend it forward so that it is flush with your torso and in the same plane. Hold for about 5 seconds, slowly lower, and switch to the opposite side. Maintain control of the core during the movement.
	**核心区肌肉牵拉** **Core area muscle stretching** 俯卧地面。双手放在身体两侧。双手放于肩部，撑起躯干。 整个上肢向后用力，进阶时可叠加头部后伸的动作，双肩向后打开，感受腰腹部、肩部前侧及颈前侧肌肉的牵拉。 动作可保持 20 秒左右，根据需要重复数次。 Lie prone on the ground. Place your hands on either side of your body. Place your hands on your shoulders and brace your torso. Force the entire upper body backward, stacking the head back for progression, and open the shoulders back to feel the pull on the muscles of the lower back and abdomen, the front of the shoulders, and the front side of the neck. The movement can be held for about 20 seconds and repeated several times as needed.

动作示意图 Movements	动作要领及注意事项 Notes
	**背部牵拉** **Back stretching** 跪姿，坐在自己的小腿及脚上。躯干及上肢逐渐趴在地面，双手尽可能向前向远伸，静态保持 30 秒。 In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper limbs on the floor, reaching your arms as far forward and as far away as possible, and hold static for 30 seconds.

第四阶段（Phase 4）

动作示意图 Movements	动作要领及注意事项 Notes
 	**跪姿三点支撑** **Kneeling three-point brace** 以跪姿四点支撑为起始动作，缓慢抬起一侧手臂，变为三点支撑，手摸同侧肩膀。 手摸肩不动，慢慢向外展开肩关节，使上臂与肩背同高，摸肩一侧肩胛骨附近的肌肉有收紧感，保持，收手臂至胸前，再回到跪姿四点支撑位。 Kneeling four-point support as the starting action, slowly raise one arm, change to three-point support, and hand touches the same side of the shoulder. Touch the shoulder without moving, slowly expand the shoulder joint outward so that the upper arm and the back of the shoulder are at the same height, and touch the shoulder side of the shoulder blade near the muscles to have a sense of tightening, hold, close the arm to the chest, and then back to the kneeling four-point support position.
	**跪姿两点支撑训练 1** **Kneeling Two-Point Support Workout 1** 单手摸肩，手肘放在胸前的三点支撑为起始动作。打开肩关节使上臂与肩背等高的同时抬起对侧下肢至与臀部同高，保持 3-5 秒后，收手臂手腿，反复 5 次，换另一侧。 One hand touching the shoulder, elbow on the chest of the three points of support for the starting movement. Open the shoulder joint so that the upper arm and the back of the shoulder at the same time lift the opposite side of the lower limbs to the same height as the buttocks, hold for 3-5 seconds, and close the arm, hand leg, repeat five times, change the other side.

动作示意图 Movements	动作要领及注意事项 Notes
	**跪姿两点支撑训练 2** **Kneeling Two-Point Support Workout 2** 以单手摸肩，手肘放在胸前的三点支撑为起始动作，缓慢打开肩关节至上臂与肩背同高，收肩关节时，收对侧腿，尽量使手肘触碰到膝关节（如图，右手肘关节约置于胸前，收左腿，尽量使左膝触碰右手肘），反复进行多次，换另一侧。 With one hand touching the shoulder, the elbow is placed in front of the chest as a three-point support for the starting movement. Slowly open the shoulder joint to the upper arm and the back of the shoulder at the same height, close the shoulder joint, and close the opposite side of the leg, as far as possible, so that the elbow touches the knee (as shown in the picture, the right elbow joint is placed approximately in front of the chest, close the left leg, as far as possible, so that the left knee touches the right elbow), repeated a number of times, and change to the other side.
	**平板支撑（plank）** 该动作为跪姿四点支撑（桥梁式支撑）的进阶。 双肘屈曲支撑在地面，脚尖踮地，小臂与大臂呈约 90 度，上臂与躯干呈约 90 度，身体离开地面。头、肩、背、臀、腿尽量位于同一高度，约与地面平行。腹部及臀部用力，保持姿势，眼睛看向地面。 This movement is a progression of the kneeling four-point brace (bridge brace). The elbows are bent and supported on the ground, the toes are on tiptoe, the lower arms are at approximately 90 degrees to the upper arms, the upper arms are at approximately 90 degrees to the torso, and the body is off the ground. Head, shoulders, back, hips, and legs try to be at the same height, approximately parallel to the ground. Exert pressure on the abdomen and hips, hold the posture, and look at the ground with your eyes.
	**平板支撑进阶——三点支撑** **Plank Support Advanced - Three-Point Support** 以平板支撑为起始位。 抬起一侧手臂，摸同侧肩膀，保持 3-5 秒，换另一侧。 同时也可以进行动态有节奏的训练，每秒换一次手臂。动作过程中注意核心区及臀部的用力，保持除手臂外的其他部分平衡。 Use plank support as the starting position. Lift one arm and touch the same shoulder, hold for 3-5 seconds, and switch to the other side. You can also perform a dynamic rhythmic workout, switching arms once per second. Pay attention to the core and glutes during the movement, keeping the rest of the body except the arms balanced.

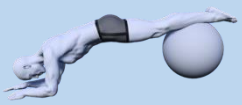
动作示意图 Movements	动作要领及注意事项 Notes
	**平板支撑进阶——两点支撑** **Plank Support Advanced - Two-Point Support** 以平板支撑为起始位。 尝试抬起一侧手臂，向前伸直与耳朵同高，伸手臂的同时，抬起对侧腿至与臀部同高（如，左手右腿），保持 3-5 秒，重复数次后换对侧。 也可以双侧交替进行练习。 Use the plank support as the starting position. Try to lift one arm, straighten it forward to the same height as your ear, and while stretching your arm, lift the opposite leg to the same height as your hip (e.g., left hand, right leg), hold for 3-5 seconds, and repeat a few times before switching to the opposite side. You can also alternate the exercise bilaterally.
	**跪姿四点支撑进阶——抬膝** **Kneeling four point brace progression - knee lift** 以桥梁式跪姿四点支撑为起始位。保持躯干平衡的情况下抬起一侧膝关节，使膝关节离开地面，再抬起另一侧膝关节。逐次放下。重复数次。 动作过程为：跪姿四点支撑——抬右膝——抬左膝——放右膝——放左膝 Use the bridge kneeling four-point brace as the starting position. Keeping your torso balanced, lift one knee off the ground and lift the other knee. Lower one at a time. Repeat several times. The course of the movement is: kneeling four-point support - lift right knee - lift left knee - lower right knee - lower left knee.
	**核心区肌肉牵拉** **Core area muscle stretching** 俯卧地面。双手放在身体两侧。双手放于肩部，撑起躯干。 整个上肢向后用力，进阶时可叠加头部后伸的动作，双肩向后打开，感受腰腹部、肩部前侧及颈前侧肌肉的牵拉。 动作可保持 20 秒左右，根据需要重复数次。 Lie prone on the ground. Place your hands on either side of your body. Place your hands on your shoulders and brace your torso. Force the entire upper body backward, stacking the head back for progression, and open the shoulders back to feel the pull on the muscles of the lower back and abdomen, the front of the shoulders, and the front side of the neck. The movement can be held for about 20 seconds and repeated several times as needed.

动作示意图 Movements	动作要领及注意事项 Notes
	**背部牵拉** **Back stretching** 跪姿，坐在自己的小腿及脚上。躯干及上肢逐渐趴在地面，双手尽可能向前向远伸，静态保持 30 秒。 正前方完成后，双手可逐渐向左、右侧移动，完成左前方、右前方（即右侧肌肉、左侧肌肉）的牵拉。 In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper extremities on the floor, reaching your hands as far forward as possible, and hold statically for 30 seconds. Once the front is completed, the hands can gradually move to the left and right to complete the left front and right front (i.e., right side muscles, left side muscles) pulls.
	**胸肌牵拉** **Pectoral stretching** 站在门框/墙壁一侧。一侧手的上臂及肘关节贴于平面拐角侧的一面，伸手的同侧下肢向前迈一步，身体以肘关节、向前伸的角为支点，缓慢转动躯干向对侧，感受抬手一侧胸肌的牵拉。 更改手臂与墙面的角度（手掌向上、向下放），同样的动作，分别牵拉胸肌的上束和下束。 Stand on the side of the door frame/wall. With the upper arm and elbow joint of one hand on the corner side of the plane, take a step forward with the lower leg on the same side of the reaching hand, and with the elbow joint, the corner of the reaching forward, as the fulcrum of the body, slowly rotate the torso to the opposite side and feel the pull on the pectoral muscles on the side of the lifting hand. Change the angle of the arm to the wall (palm up, down), the same action, respectively, pulling the upper and lower bundles of the pectoral muscles.

第五阶段（Phase 5）

动作示意图 Movements	动作要领及注意事项 Notes
	**仰卧空中双脚相对** **Lie on your back with your feet facing each other in the air** 该动作为一系列训练的起始动作。 仰卧，双手放在身体两侧。分别举起两侧双腿至空中，脚掌相对并保持。 动作过程中，保证下腰部及核心区完全贴地，避免腰部形成“桥梁式”空隙。

动作示意图 Movements	动作要领及注意事项 Notes
	This movement is the starting movement for a series of exercises. Lie on your back with your hands on either side of your body. Raise each leg into the air, keeping the feet opposite each other. During the movement, make sure that your lower back and core are completely on the ground, avoiding the formation of a "bridge" gap in the lower back.
	**仰卧空中双脚相对变式 1** **Supine raising feet in the air variation 1** 以仰卧空中双脚相对作为动作起始。 双手放在身体两侧，以手掌小拇指侧立于地面的姿势，静力性保持。 动作过程中，收紧核心区及臀部肌肉，手掌侧面向地面用力。 Start the movement by lying on your back with your feet facing each other in the air. Place your hands on either side of your body in a static holding position, with the side of the pinky of your hand standing on the ground. During the movement, tighten the core and gluteal muscles and press the side of the palms toward the ground.
	**仰卧空中双脚相对变式 2** **Supine raising feet in the air variation 2** 以仰卧空中双脚相对动作起始。双手放在耳侧。 缓慢放下左侧脚，但不接触地面，膝关节保持屈曲。同时将右胳膊从耳旁缓慢打开至“平举状态”（如图）。再收右手和左腿至起始位，换左臂和右腿，重复进行。 Start the movement by lying on your back with your feet facing each other in the air. Place your hands on the side of your ears. Slowly lower the left foot without touching the floor, keeping the knee flexed. At the same time, slowly open your right arm away from your ear to a "plank position" (as shown). Bring the right hand and left leg back to the starting position, switch to the left arm and right leg, and repeat.
	**俯卧提膝变式** **Prone knee lift variation** 俯卧位，双肘撑地，脚尖踮地，双脚撑起膝关节，保持该动作。 动作过程中，核心区收紧，背部收紧。（此时为俯卧四点支撑）保持提膝状态，缓慢抬起右手臂伸直至与耳同高，逐渐将右手臂向侧面平移打开，如图，再返回至与耳同高，将右手臂放回地面支撑，换左侧。重复数次。 Hold the movement in a prone position with your elbows on the floor and your toes on the ground, with your feet braced on your knees. During the movement, tighten the core and tighten the

动作示意图 Movements	动作要领及注意事项 Notes
	back. (Prone four-point brace at this point) Keeping your knees lifted, slowly lift your right arm and extend it until it is at the same height as your ear, gradually flatten your right arm to the side and open it up as shown, then return it to the same height as your ear, return your right arm to the floor for support and switch to the left side. Repeat several times.
	**伏地俯身登山** **Crouch down and climb** 以平板支撑的姿势为起始动作。 左右两侧交替屈髋屈膝，感受大腿贴近腹部的感觉。激活腹部肌肉的动态收缩。 动作过程中臀部用力，维持躯干的平衡。 Start the movement in a plank position. Alternate bending the hips and knees on the left and right sides, feeling the thighs close to the abdomen. Activate the dynamic contraction of the abdominal muscles. Exert your hips during the movement to maintain the balance of your torso.
	**瑜伽球辅助平衡训练 1** **Yoga Ball Assisted Balance Training 1** 使瑜伽球放在上背部（肩胛骨区域）。双脚撑地，髋关节尽力向上顶。通过核心及肩背力量控制住瑜伽球，保持稳定。 稳定后，尝试双脚向后退步，使瑜伽球在整个背部范围有规律的前后移动。动作过程中，尽量保持核心肌肉的稳定性，使动作有控制性且流畅。 Keep the yoga ball on your upper back (shoulder blade area). Brace your feet on the ground and thrust your hips upward as far as you can. Keep the ball stable by controlling it through your core and shoulder, and back strength. Once stabilized, try to step backward with both feet so that the ball moves back and forth regularly over the entire range of your back. During the movement, try to keep your core muscles stable so that the movement is controlled and smooth.
	**瑜伽球辅助平衡训练 2** **Yoga Ball Assisted Balance Training 2** 将瑜伽球放在小腿前侧的下面，进阶后可将瑜伽球放在踝关节下方（即减少身体与瑜伽球的接触）。 双肘撑地，保持身体和躯干的平衡，用身体的力量找到“稳定点”，控制住，使瑜伽球不移动。 稳定后，加大难度，尝试在该动作的基础上，运用核心力量屈髋屈膝，使瑜伽球往前移动（即收缩腹直肌），再至起始动作，重复数次。

动作示意图 Movements	动作要领及注意事项 Notes
	此类训练为增加不稳定因素的动态平衡训练，对核心区的控制和力量要求更高。 Place the ball underneath the front of the calf, or in more advanced positions, underneath the ankle (i.e., to minimize contact between the body and the ball). Keep your body and torso balanced with your elbows on the ground, and use your body's strength to find a "stabilizing point" to keep the ball in control and keep it from moving. After stabilizing, increase the difficulty and try to use your core strength to flex your hips and knees to move the ball forward (i.e., contract your rectus abdominis muscles), then go back to the starting movement and repeat several times. This type of training is dynamic balance training with increased instability and requires more control and strength in the core area.
	**背部牵拉** **Back stretching** 跪姿，坐在自己的小腿及脚上。躯干及上肢逐渐趴在地面，双手尽可能向前向远伸，静态保持 30 秒。 完成后，分别双手爬行移动至左前方、右前方，每侧保持 30 秒左右，可重复进行。 In a kneeling position, sit on your calves and feet. Gradually lie your torso and upper limbs on the ground and reach your hands as far forward as possible, holding static for 30 seconds. Upon completion, crawl and move to the left front and right front with both hands, respectively, holding for about 30 seconds on each side, which can be repeated.
	**跪姿三角肌牵拉** **Kneeling deltoid stretching** 双脚及膝关节支撑，臀部坐在小腿上。 如图为右侧三角肌牵拉。右手向斜前方伸直，左侧手置于右手前臂外侧，右手手臂给左手前臂施加缓慢持续的力（以杠杆原则，用最少的力做最有效的牵拉）。 维持 20 秒，换另一侧。 The feet and knees are supported, and the hips sit on the calves. The right deltoid pull is shown. With your right hand straight out in front of you diagonally, place your left hand on the outside of your right forearm and apply a slow, sustained force from your right arm to your left forearm (using the principle of leverage to make the most effective pull with the least amount of force). Hold for 20 seconds and switch to the other side.

动作示意图 Movements	动作要领及注意事项 Notes
	**腹外斜肌及体侧肌肉牵拉** **External abdominal obliques and somatic muscle stretching** 双脚及膝关节支撑，臀部坐在小腿上。 被牵拉侧的手臂伸至头顶上方。缓慢倾斜躯干，感觉到躯干侧方手臂下侧大肌群的牵拉。 The feet and knees are supported, and the buttocks sit on the calves. The arm on the side being pulled is extended above the head. Slowly tilt the torso and feel the pull on the large muscle group on the lower side of the arm on the side of the torso.

Appendix 5 Roland-Morris Disability Questionnaire

腰椎功能障碍问卷（Chinese version）

序号	现阶段存在问题	是	否
1	由于腰腿痛，大部分时间都呆在家里		
2	为减轻腰腿痛，经常要变换体位		
3	由于腰腿痛，比平常走得慢		
4	由于腰痛，不能做平常能做的家务		
5	由于腰痛，上楼时常用扶手		
6	由于腰痛，更多时候躺下休息		
7	由于腰痛，从椅子上起来时必须用扶手		
8	由于腰痛，常请求他人帮助自己做事		
9	由于腰痛，穿衣比平时慢		
10	由于腰痛，只能短时间站立		
11	由于腰痛，不能弯腰或跪着		
12	由于腰痛，做起来有困难		
13	腰背部全天都在痛		
14	由于腰痛，在床上翻身有困难		
15	由于腰痛，胃口不是很好		
16	穿袜子有困难		
17	由于腰痛，只能短距离行走		
18	腰痛影响睡眠		
19	由于腰痛，需要他人帮助穿衣裤		
20	由于腰痛，一天大部分时间是坐着		
21	由于腰痛不能干重活		
22	由于腰痛，比平时更易急躁和发脾气		
23	由于腰痛，上楼梯比平时更慢		
24	由于腰痛，整日需卧床休息		
总分			

Roland-Morris Disability Questionnaire (English version)

	Question	Yes	No
1	I stay at home most of the time because of my back.		
2	I change position frequently to try and get my back comfortable.		
3	I walk more slowly than usual because of my back.		
4	Because of my back, I am not doing any of the jobs that I usually do around the house.		
5	Because of my back, I use a handrail to get upstairs.		
6	Because of my back, I lie down to rest more often.		
7	Because of my back, I have to hold on to something to get out of an easy chair.		
8	Because of my back, I try to get other people to do things for me.		
9	I get dressed more slowly than usual because of my back.		
10	I only stand for short periods of time because of my back.		
11	Because of my back, I try not to bend or kneel down.		
12	I find it difficult to get out of a chair because of my back.		
13	My back is painful almost all the time.		
14	I find it difficult to turn over in bed because of my back.		
15	My appetite is not very good because of my back pain.		
16	I have trouble putting on my socks (or stockings) because of the pain in my back.		
17	I only walk short distances because of my back.		
18	I sleep less well because of my back.		
19	Because of my back pain, I get dressed with help from someone else.		
20	I sit down for most of the day because of my back.		
21	I avoid heavy jobs around the house because of my back.		
22	Because of my back pain, I am more irritable and bad-tempered with people than usual.		
23	Because of my back, I go upstairs more slowly than usual.		
24	I stay in bed most of the time because of my back.		
score			

Appendix 6 Low Back Pain Knowledge Questionnaire

下背部知识问卷

性别：　　出生日期：　　年　月　日　　学历：　　□刚入院　□即将出院

该问卷的目的旨在评估对下腰痛知识的了解。请根据题目选出每个问题符合题干的选项，如果您不知道问题答案，请选择“我不了解”。

1. 根据一般脊柱排列解剖学知识，选出一个<u>错误</u>描述：

a) 脊柱包含颈椎、胸椎、腰椎和骶部。
b) 每一个椎骨间，都有椎间盘充当“减震器”的作用。
c) 椎骨间有供脊髓穿过的通道。
d) 腰背部及腹部肌肉功能没有支撑脊柱的功能。。
e) 我不了解。

2. **什么是下腰痛？选择一个<u>正确</u>选项：**

a) 发生区域在最底部肋骨及骨盆之间区域的疼痛。
b) 发生区域在最底部肋骨及骨盆间，痛感可放射至腿部及足部的疼痛。
c) 从颈部至臀部区域，发生在背部任意部位的疼痛。
d) 在腹部、骨盆下部或靠近肾脏区域部位的疼痛。
e) 我不了解。

3. **什么是急性下腰痛？选择一个<u>正确</u>选项：**

a) 发生在腰部，通过治疗或未经治疗在三周内可改善的疼痛。
b) 发生在腰部未经治疗的疼痛。
c) 发生在腰部需要经手术治疗的疼痛。
d) 发生在腰部，持续时间超过三个月的疼痛。
e) 我不了解。

4. 什么是慢性下腰痛？选择一个<u>正确</u>选项：

a) 发生在腰部，通过治疗或未经治疗在三周内可改善的疼痛。
b) 发生在腰部未经治疗的疼痛。
c) 发生在腰部需要经手术治疗的疼痛。
d) 发生在腰部，持续时间超过三个月的疼痛。
e) 我不了解。

5. 什么是坐骨神经痛？选择一个<u>正确</u>选项：

a) 发生在最底部肋骨及骨盆之间区域的疼痛。
b) 发生区域在最底部肋骨及骨盆间，痛感可放射至腿部及足部的疼痛。
c) 从颈部至臀部区域，发生在背部任意部位的疼痛。
d) 在腹部、骨盆下部或靠近肾脏区域部位的疼痛。
e) 我不了解。

6. 造成下腰痛的病因有哪些？选择<u>两个正确</u>选项：

a) 寒冷及年龄增长。
b) 不良姿势，关节疾病和椎间盘突出。
c) 肿瘤，感染及骨折。
d) 糖尿病。
e) 我不了解

7. 下腰痛的疾病征象有哪些？选择<u>两个正确</u>选项：

a) 咳嗽，食欲不振，精神萎靡。
b) 身体疲惫及疼痛。
c) 腰部疼痛，搬重物时疼痛加重。
d) 从地面搬起物体时感到困难。
e) 我不了解

8. 有关确诊下腰痛需要的检查有哪些？

选择两个正确选项：

a) 必须进行核磁共振（MRI）及计算机断层扫描成像（CT）。
b) X 光不是必要的。
c) 通常可以通过病史及对患者进行体格检查确诊，无需进行其他辅助检查。
d) 必须进行血糖、胆固醇、尿检等其他医学实验室检查。
e) 我不了解

9. 关于药物治疗下腰痛，选择一个正确选项：

a) 急性发病期可能需要使用消炎药及镇痛药。
b) 急性发病期可能必须使用皮质醇。
c) 对于慢性下腰痛可能需要使用抗抑郁药及抗惊厥药。
d) 通常使用如凝胶、软膏、膏药等外用药物。
e) 我不了解

10. 治疗急性下腰痛，选择两个正确选项：

a) 需要一周时间绝对卧床休息。
b) 需要请病假休养。
c) 即使没有进行任何治疗，下腰痛也有可能缓解。
d) 不需要休息。
e) 我不了解。

11. 治疗慢性下腰痛可以采取哪些方式？选择两个正确选项：

a) 长期服用抗炎药。
b) 使用保护脊柱及正确运动的指导说明。
c) 进行大强度活动时，使用护腰。
d) 进行类似短波、超声波、热疗的物理治疗比进行针对性的体育锻炼更重要。
e) 我不了解。

12. 对于体育活动和下腰痛，选择一个不正确的选项：

a) 每周三次，每次一小时的散步可改善慢性下腰痛。
b) 急性下腰痛患者应加强体育锻炼。
c) 急性下腰痛患者可进行水中体育锻炼。
d) 最推荐的锻炼是强化腹部及腰背部肌肉力量，进行拉伸及调节的运动。
e) 我不了解。

13. 为了保护脊柱健康，选择两个正确选项：

a) 最佳的睡眠姿势是俯卧式（趴着）。
b) 坐着完成穿袜子、穿鞋的日常活动。
c) 捡起地上的物品时，保持膝关节不弯曲。
d) 洗碗时使用腹部抵住水槽站立的姿势。
e) 我不了解。

14. 为了保护脊柱健康，选择一个不正确的选项：

a) 下床时动作小心，用双手辅助完成身体转向动作。
b) 避免单侧身体过度承重（用双手均匀分担重物重量）。
c) 避免脊柱过度扭转。
d) 每天穿高跟鞋。
e) 我不了解。

15. 关于急性下腰痛，选择两个正确选项：

a) 多数病人在三周内能恢复健康。
b) 在身体恢复，疼痛减轻后，病人能够痊愈并无其他长期风险。
c) 保护脊柱健康的指南只在疾病危险期适用。
d) 在有腰痛病史的患者中，需要长期关注脊柱保护及肌力维持，因为复发风险较高。
e) 我不了解。

16. 对于下腰痛的手术治疗，选择两个正确选项：

a) 只在少数情况下建议手术治疗。
b) 对于通过临床治疗，病情并未改善的神经根压迫型颈椎病及脊柱不稳患者，采取手术治疗很有必要。
c) 手术治疗可以使下腰痛痊愈。
d) 对于任何类型的下腰痛患者，手术治疗都是最好的选择。
e) 我不了解。

Low Back Pain Knowledge Questionnaire (English version)

1）Please choose one wrong description based on the anatomy basics of spine structure:

a) The spine is composed of the cervical vertebra, thoracic vertebra, lumbar vertebra, and sacral vertebrae.

b) There is an intervertebral disc between each two vertebrae, which acts as a "shock absorber."

c) There are pathways between the vertebrae through which the spinal cord passes.

d) Muscles at lower back and abdomen can not support the spine.

e) I have no idea.

2）What is the definition of lower back pain? Please choose one right option:

a) Pain occurring at the bottom of the ribs and the area between the pelvis.

b) Pain occurring at the bottom of the ribs and the area between pelvis, the painful feeling of which can spread to legs and feet.

c) Pain occurring at any site of the back (the area between neck and the buttock).

d) Pain occurring at abdomen, lower part of pelvis, or the area close to the kidney.

e) I have no idea.

3）What is the definition of acute lower back pain? Please choose one right option:

a) Pain occurring at the lumbar area that can be improved within three weeks with or without treatment.

b) Pain occurring at the lumbar area that has not been treated.

c) Pain occurring at the lumbar area that requires treatment by means of surgery.

d) Pain occurring at the lumbar area, with a duration of over three mouths.

e) I have no idea.

4）What is the definition of chronic lower back pain? Please choose one right option:

a) Pain occurring at the lumbar area that can be improved within three weeks with or without treatment.

b) Pain occurring at the lumbar area that has not been treated.

c) Pain occurring at the lumbar area that requires treatment by means of surgery.

d) Pain occurring at the lumbar area, with a duration of over three mouths.

e) I have no idea.

5）What is the definition of sciatica? Please choose one right option:

a) Pain occurring at the bottom of the ribs and the area between the pelvis.

b) Pain occurring at the bottom of the ribs and the area between pelvis, the painful feeling of which can spread to legs and feet.

c) Pain occurring at any site of the back (the area between neck and the buttock).

d) Pain occurring at abdomen, lower part of pelvis, or an area close to the kidney.

e) I have no idea.

6）What are the causes of lower back pain? Please choose two right options:

a) Cold (environment) and aging.

b) Wrong posture, joint diseases, and protrusion of intervertebral disc.

c) Tumor, infection, and fracture.

d) Diabetes.

e) I have no idea.

7） What are the signs and symptoms of lower back pain? Please choose two right options:

a) Cough, loss of appetite, and energielos (laziness).

b) Feeling tired and painful.

c) Feeling pain at the lumbar area, and the pain aggravated when lifting heavy objectves.

d) Feeling hard to lift heavy objects from the ground.

e) I have no idea.

8） What are the examinations necessary for diagnosing lower back pain? Please choose two right options:

a) Must perform magnetic resonance imaging (MRI) and computed tomography (CT).

b) X-ray is unnecessary.

c) Diagnosis can usually be made based on the medical history of the patient and the results of physical examinations, and other auxiliary examinations are unnecessary.

d) Medical laboratory examinations (such as blood glucose, cholesterol, urine, etc.) must be performed.

e) I have no idea.

9） Please choose one right description of drug therapy for lower back pain.

a) Anti-inflammatory drugs and analgesics (or painkillers) might be needed in the acute stage of onset.

b) Cortisol must be used in the acute stage of onset.

c) Antidepressants and anticonvulsants might be necessary for chronic lower back pain.

d) Some agents (such as hydrogel, ointment, or plaster) are always adopted for external application.

e) I have no idea.

10） What actions shall be taken for therapy of lower back pain? Please choose two right options:

a) One-week rest in bed is mandatory.

b) The patient needs to take sick leave and rest.

c) The lower back pain can be relieved even without any kind of treatment.

d) There is no need to rest.

e) I have no idea.

11） What can be done to treat chronic lower back pain? Please choose two right options:

a) Long-term administration of the anti-inflammatory agent.

b) Provide the patient with guidance and instructions on spine protection and how to do physical exercises properly.

c) Use a waist support device for protection while engaging in activities with high intensity.

d) Compared with targeted physical exercises, physiotherapy approaches (such as shortwave treatment, ultrasonic therapy, and thermal therapy) are more important.

e) I have no idea.

12） Please choose one wrong description of physical activities and lower back pain.

a) Take a walk three times a week, one hour for each can help relieve chronic lower back pain.

b) Patients with acute lower back pain shall take more physical exercise.

c) Patients with acute lower back pain can do physical activities in water.

d) Physical activities recommended the most are those that can enhance the strength of abdominal and lower back

muscles and are helpful for stretching and adjustment.
e) I have no idea.

13） Please choose two right descriptions on spine protection.
a) The best sleeping posture is a prone position (lying on one's stomach).
b) Finish daily activities such as wearing socks and shoes while sitting.
c) Keep the knee joints unbent while picking up objects from the ground.
d) Stand with the stomach against the sink while doing the dishes.
e) I have no idea.

14） Please choose one description that is not helpful for spin protection:
a) Be careful when getting out of bed. Use two hands to help turn your body around.
b) Avoid excessive load bearing at one side of the body (i.g. use two hands to share the weight evenly).
c) Avoid twisting the spine excessively.
d) Wear high heels every day.
e) I have no idea.

15） Please choose two right descriptions of acute lower back pain.
a) Most patients can recover within three weeks.
b) After recovery and relief of pain, the patients can be cured, and there is no long-term risk.
c) The guidance for spine protection is only applicable during critical stages of the disease.
d) The risk of recurrence is high. Thus, for patients with a medical history of low back pain, attention shall be paid to spine protection and myodynamia maintenance.
e) I have no idea.

16） Please choose two right descriptions for surgical treatment of lower back pain.
a) Surgical treatment is only recommended in a few cases.
b) Surgical treatment is necessary for patients with nerve root compression, cervical spondylotic, and spinal instability whose condition did not improve through clinical treatment.
c) The lower back pain can be cured with surgical treatment.
d) Surgical treatment is the best option for patients with any kind of lower back pain.
e) I have no idea.

Appendix 7 Global Physical Activity Questionnaire

Chinese version

核心内容：体力活动			
下面我要询问你通常每周做各类体力活动所花费的时间。请回答下列问题（即使你认为自己不经常参加体力活动）。 首先谈到工作中的体力活动。工作是指你必须完成的有酬或无酬工作，学习/培训，家务，收割食物/粮食，渔业或猎捕食物，以及找工作。 关于剧烈活动，是指高负荷的体力活动并引起呼吸心跳显著增加。中等强度的活动是指一定负荷的体力活动并引起呼吸心跳轻度增加。			
问题		**回答**	**代码**
工作时的体力活动			
54	你的工作需要做剧烈活动以致引起呼吸和心跳显著增加［ 如搬运或举重物、挖掘或建筑工作 ］时间至少持续 10 分钟吗？	是 1 否 2 若为否，跳至 P4	P1
55	你的工作中通常每周有多少天会做剧烈活动？	天数 ⌊⌋	P2
56	你通常每天工作中做多长时间的剧烈活动？	小时：分钟 ⌊⌋⌊⌋：⌊⌋⌊⌋ 小时 分	P3 (a-b)
57	你的工作需要做引起呼吸和心跳轻度增加的中等强度活动，如快步走［ 搬运较轻的物品 ］时间至少持续 10 分钟吗？	是 1 否 2 若为否，跳至 P7	P4
58	你通常每周有多少天工作时做中等强度的活动？	天数 ⌊⌋	P5
59	你通常每天工作时做多长时间中等强度的活动？	小时：分钟 ⌊⌋⌊⌋：⌊⌋⌊⌋ 小时 分	P6 (a-b)
交通时的体力活动			
以下问题不包括上述工作时的体力活动。 现在我要询问你通常的交通方式。例如，去上班、去购物、去市场等			
60	你去某个地方时步行或骑自行车至少持续 10 分钟以上吗？	是 1 否 2 若为否，跳至 P10	P7
61	你通常每周有多少天从一个地点到另一地点步行或骑自行车至少持续 10 分钟以上?	天数 ⌊⌋	P8
62	你通常每天在交通方面花多少时间步行或骑自行车？	小时：分钟 ⌊⌋⌊⌋：⌊⌋⌊⌋ 小时 分	P9 (a-b)
娱乐性体力活动			
以下问题不包括上述的工作和交通过程中的体力活动。 现在我询问你有关运动、健身和娱乐性体力活动（休闲）的问题			
63	你进行引起你呼吸和心跳显著增加的剧烈的运	是 1	P10

	动、健身和娱乐性（休闲）体力活动并至少持续 10 分钟以上吗？	否 2 若为否，跳至 P13	
64	你通常每周有多少天进行剧烈的运动、健身和娱乐性（休闲）体力活动?	天数 ⌊_⌋	P11
65	你通常每天花多长时间进行剧烈的运动、健身和娱乐性体力活动？	小时：分钟 ⌊_⌋⌊_⌋：⌊_⌋⌊_⌋ 小时 分	P12 (a-b)
66	你进行引起你呼吸和心跳轻度增加的中等强度的运动、健身和娱乐性体力活动（休闲），如快步走（骑自行车、游泳、排球）至少持续 10 分钟或以上吗？	是 1 否 2 若为否，跳至 P16	P13
67	你通常每周有多少天进行中等强度的运动、健身和娱乐性（休闲）体力活动?	天数 ⌊_⌋	P14
68	你通常每天花多少时间进行中等强度的运动、健身和娱乐性（休闲）体力活动？	小时：分钟 ⌊_⌋⌊_⌋：⌊_⌋⌊_⌋ 小时 分	P15 (a-b)
扩展内容：体力活动			
久坐习惯			
以下问题是关于工作时、在家里、交通过程中、会朋友时坐姿或靠着所花费的时间。 包括坐在桌前，与朋友一起坐着，乘坐轿车、公共汽车、火车，阅读，打扑克或看电视，但不包括睡觉的时间。			
69	你通常每天有多少时间坐着或靠着？	小时：分钟 ⌊_⌋⌊_⌋：⌊_⌋⌊_⌋ 小时 分	P16 (a-b)

English Version

Physical Activity			
Next, I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do, such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, and seeking employment. In answering the following questions, 'vigorous-intensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, and 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.			
Questions		**Response**	**Code**
Activity at work			
54	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate, like *[carrying or lifting heavy loads, digging, or construction work*] for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to P4*	P1
55	In a typical week, how many days do you do vigorous-intensity activities as part of your work?	Number of days ⌊__⌋	P2
56	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P3 (a-b)
57	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate, such as brisk walking *[or carrying light loads*] for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to* P7	P4
58	In a typical week, how many days do you do moderate-intensity activities as part of your work?	Number of days ⌊__⌋	P5
59	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P6 (a-b)
Travel to and from places.			
The next questions exclude the physical activities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and from places. For example, to work, for shopping, to market, to place of worship.			
60	Do you walk or use a bicycle (*pedal cycle*) for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to* P10	P7
61	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days ⌊__⌋	P8
62	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P9 (a-b)
Recreational activities			
The next questions exclude the work and transport activities that you have already mentioned.			

Now I would like to ask you about sports, fitness and recreational activities (leisure).			
63	Do you do any vigorous-intensity sports, fitness, or recreational (*leisure*) activities that cause large increases in breathing or heart rate, like [*running or football,]* for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to* P13	P10
64	In a typical week, how many days do you do vigorous-intensity sports, fitness, or recreational (*leisure*) activities?	Number of days ⌊__⌋	P11
65	How much time do you spend doing vigorous-intensity sports, fitness, or recreational activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P12 (a-b)
66	Do you do any moderate-intensity sports, fitness, or recreational *(leisure*) activities that cause a small increase in breathing or heart rate, such as brisk walking (*cycling, swimming, volleyball*)for at least 10 minutes continuously?	Yes 1 No 2 *If No, go to* P16	P13
67	In a typical week, how many days do you do moderate-intensity sports, fitness, or recreational (*leisure*) activities?	Number of days ⌊__⌋	P14
68	How much time do you spend doing moderate-intensity sports, fitness, or recreational (*leisure*) activities on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P15 (a-b)
Sedentary behavior			
The following question is about sitting or reclining at work, at home, getting to and from places, or with friends, including time spent [sitting at a desk, sitting with friends, traveling in a car, bus, train, reading, playing cards or watching television], but do not include time spent sleeping.			
69	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes ⌊__⌋⌊__⌋ : ⌊__⌋⌊__⌋ hrs mins	P16 (a-b)

Appendix 8 Ethic approval

成都体育学院附属体育医院伦理委员会
伦理审查批件

伦审（2020）第 002 号

论文题目	中文版下腰痛知识问卷信效度分析及影响因素的研究				
研究类型	□动物实验 □回顾性观察性研究 √前瞻性观察性研究 □临床试验				
研究时间	2020年6月1日至 2020年10月31日			第一作者	王哲
主要研究者	王哲 黄继超			通讯作者	王哲
研究部门	康复科	研究负责人	黄继超	职 称	
委员人数	20		出席人数	18	
Δ同意	18				
Δ修改后同意					
Δ修改后重审					
Δ不同意					

审批意见：

审查通过

成都体育学院附属体育医院伦理委员会
（盖章）
2020 年 5 月 30 日

PÉCSI TUDOMÁNY EGYETEM
Klinikai Központ
Regionális Kutatásetikai Bizottság

Wang Zhe PhD student
Vizsgálatvezető / Principal Investigator:
Doctoral School of Health Sciences,
Faculty of Health Sciences, University of Pécs
PTE ETK Fizioterápiás és Sporttudományi Intézet

Pécs, 10th of June 2022.

Témavezető / Supervisors: dr. Járomi Melinda egyetemi docens
Társtémavezető: dr. Makai Alexandra egyetemi adjunktus
PTE ETK Fizioterápiás és Sporttudományi Intézet

Cím / Title: Egy 12 hetes „Hát Iskola", hát erősítő torna gyakorlat hatása a Magyarországon élő kínai embereken The impact of a 12-weeks Back School intervention on Chinese people in Hungary

Sponzor / Sponsor: saját kezdeményezésű klinikai vizsgálat – self – initiated programme to improve the life conditions of patients suffering from LBP – Low Back Pain

Mellékletek / Supplements from the PI: (1.) Research plan; (2.) Questionnaires; (3.) Information leaflet – Invitation to the participants; (4.) Inform content; (5.) Support letter from the Dean of Faculty of Health Sciences; (6.) Support letter from the Doctoral School;

vizsgálatvezető a következő dokumentumokat terjesztette be: (1.) tudományos és irodalmi háttér; (2.) protokoll; (3.) betegtájékoztató és (4.) beleegyező nyilatkozat; (5.) befogadó és támogató nyilatkozat az ETK dékánjától és az ETK Doktori Iskola részéről;

Döntés: a PTE KK RKEB **2022. június 10.-én tartott ülésükön** a kialakult szakmai és etikai állásfoglalás alapján a Bizottság **tudomásul vette** a vizsgálat protokoll szerinti kivitelezését
Decision: The Regional Research Ethics Committee as the Institutional Review Board **discussed** your application on their meeting held on 10th of June 2022. and they **approved** the study protocol.

Record number 9272 – PTE 2022.

Yours sincerely

PÉCSI TUDOMÁNYEGYETEM Regionális Kutatásetikai Bizottság 1. KLINIKAI KÖZPONT

Samuel Komoly
Professor of Neurology
Chairman of the Regional Research Ethics
Committee of the Medical Center, Pécs
Institutional Review Board
H-7623 Rákóczi str. 2. Pécs/HUNGARY
phone 00-36-72-536302
fax 00-36-72-536301

Béla Kocsis
Associate professor of Clinical Microbiology
Secretary of the Regional Research Ethics
Committee of the Medical Center, Pécs
Institutional Review Board
H-7624 Szigeti str. 12. Pécs/HUNGARY
phone 00-36-72-536001-31905
fax 00-36-72-536253

Submission of the doctoral dissertation and declaration of the originality of the dissertation

The undersigned,
Name: **Zhe**
Maiden name: **Wang**
Mother's maiden name: **Tang**
Place and time of birth: **Ürümqi China, 29 November 1994**

on this day submitted my doctoral dissertation entitled:

Application of Disease-Specific Knowledge in the Rehabilitation Process – Based on the Effects of Back School Program among Chinese Adults

to the

PR-7, **Sport and Health Sciences** Programme

of the Doctoral School of Health Sciences, Faculty of Health Sciences, University of Pécs.

Names of the supervisor(s):

Dr. Járomi Melinda, Dr. Makai Alexandra

At the same time, I declare that
- I have not submitted my doctoral dissertation to any other Doctoral School (neither in this country nor abroad),
- my application for degree earning has not been rejected in the past two years,
- in the past two years I have not had unsuccessful doctoral procedures,
- my doctoral degree has not been withdrawn in the past five years,
- my dissertation is independent work, I have not presented others' intellectual work as mine, the references are definite and full, on preparation of the dissertation I have not used false or falsified data.

Dated: November 17th 2023

signed by Candidate

Supervisor

Co-supervisor