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

Ph.D. Dissertation Booklet

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Abbreviations

Abbreviation	
BSP	Back School program
CG	Control group
cLBP	Chronic low back pain
ESCI	Emerging Sources Citation Index
GPAQ	Global physical activity questionnaire
ICC	Intraclass correlation
IG	Intervention group
KMO	Kaiser-Meyer-Olkin
LBP	Low back pain
LKQ	Low back pain knowledge questionnaire
PA	Physical activity
Q value	Modularity Q value
R-MDQ	Roland-Morris disability questionnaire
SCI-Expanded	Science Citation Index Expanded
sC-LKQ	Simplified Chinese Low Back Pain Knowledge Questionnaire
SSCI	Social Sciences Citation Index
S value	Silhouette value
USA	United States of America
WOS	Web of Science
WOSCC	Web of Science Core Collection

Chapter 1 Introduction

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 (Forssell, 1981). After this, the BSP spread to the Americas and many other European countries (Mattmiller, 1980. Keijsers et al., 1989. David et al., 1992). 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 (Oliveira et al., 2022). This lifestyle has contributed to the increasing frequency of low back pain (Manchikanti, 2000). 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 (Dong et al. 2019). Although there are many studies related to treating and rehabilitating LBP in China, there are no studies on BSP intervention modalities. There is also no content that 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.

Purpose and Objectives

The purpose of this study was to investigate the impact of BSP on the Chinese in Hungary. The specific objectives showing 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.

Theoretical framework

The current study is based on a combination of the social-ecological model and cognitive learning theory (McLaren et al., 2005. Bandura, 1989). 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.

(Sub-study 1)

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

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 (Vos et al., 2016. Wu et al., 2017. Jin et al., 2020). Understanding the disease-specific aspects of LBP is crucial for preventing and treating spinal diseases (Weckbach et al., 2016. Sharafkhani et al., 2014).

In China, the prevalence of LBP is increasing because of the population's higher mean age and life expectancy (GBD 2017 Population and Fertility Collaborators, 2018. Zhou et al., 2019). Spinal pain is anticipated to worsen the public health burden with population aging (Wei et al., 2019). 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.

Methods and Materials

Participants

Four hundred thirty-one participants participated in the cross-sectional quantitative study in China and Hungary between September 2021 and June 2022. 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.

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: Chinese people living in Hungary with health sciences or medical education backgrounds. Group 6: 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.

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 (Beaton et al., 2000).

Thirty participants aged over 18 years participated in the pilot test of the sC-LKQ.

Instruments

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

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.

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 items self-administration questionnaire, especially for back pain (Roland et al., 1983). 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 (Fan et al., 2012).

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. Correlation analysis was performed to compare the association between demographic characteristics and sC-LKQ. A p-value lower of 0.05 was regarded as statistically significant.

Cronbach's alpha coefficient value was used to measure the internal consistency. The intraclass correlation (ICC) and Bland-Altman graph with a 95% bound of the agreement were used to evaluate test-retest reliability.

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 (Koo et al., 2016).

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

Results

Of the 428 Chinese participants (183 males, 245 females) mean age was 30.90 ± 11.30 years old. 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). 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.

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% confidence interval, 0.61-0.94), reflecting good test-retest reliability of sC-LKQ. The Bland-Altman mean value was -0.13 ± 2.34 (95% limits of agreement, -4.70 to 4.45). There was no significant proportional bias between the test and retest.

Construct validity and concurrent validity

The KMO value was 0.864, and Bartlett's test value 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.

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.

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).

Discussion

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) (Maciel et al., 2009) but lower than that of the Hungarian (Cronbach's alpha =0.894) and one of the Arabic (Cronbach's alpha=0.834) versions (Waleed et al., 2017. Kovács-Babócsay et al., 2019) 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 (Maciel et al., 2009). Therefore, the sC-LKQ has high reliability.

The construct validity results showed that the sC-LKQ could be divided into five components. 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).

In this study, the average score of sC-LKQ and the scores for the three areas of general knowledge, concepts, and treatment were similar to that previous Chinese LKQ study (Xiang et al., 2016). These results corroborate that Chinese people have a low level of knowledge of the concept of LBP. But the LKQ scores of patients with LBP in this study were lower than those reported in the previous Chinese study.

The sC-LKQ has acceptable concurrent validity by a strong connection with R-MDQ. Meanwhile, the sC-LKQ score had a significant positive correlation with education level and medical background.

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, in our study, not all specialize in spinal health or related fields. Another possible explanation for this is the differences in sample size.

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.

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.

(Sub-study 2)

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

Introduction

Over the past three years, the massive worldwide epidemic of Covid-19 has added social isolation in life (Hruschak et al., 2021). Lifestyle changes have reduced physical activity and increased sedentary behavior, including university students (Stockwell et al., 2021). Besides, physical activity is one factor influencing the incidence of LBP (Papalia et al., 2022).

European clinical guidelines emphasize the value of exercise and educational treatments to prevent and treat LBP (Burton et al., 2006). The BSP was 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 (Poquet et al., 2016). 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

Material and Methods

Study design and participants

This was a convenience sample study. Participants were recruited through 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 four of them drooped. The final number of participants was 21, 10 in the intervention group (IG) and 11 in the control group (CG).

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 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.

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.

Measurements

All subjects underwent posture measurements on a voluntary basis and with privacy protection, including the line of gravity, 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.

Instruments

This study used two LBP-specific questionnaires (LKQ and R-MDQ), one

demographic questionnaire, and a physical activity questionnaire (the Global Physical Activity Questionnaire, GPAQ).

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.

Results

Baseline data

Finally, there were 21 participants in total recruited for the study. All participants were in tertiary education (undergraduate and above). There did not have any significant differences between IG and CG.

Posture examination

In the basic body measurements, unbalance and asymmetry were observed in both intervention and control groups. 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 ($Z=-1.102$, $p=0.270$).

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 result in 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).

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 had 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. 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).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).

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.

Discussion

In general awareness, both patients, clinicians, and researchers believe that movement and posture are associated with LBP (Chan et al., 2020. O'Sullivan et al., 2005. Lin et al, 2013). This is also reflected in our study.

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. (Hernandez-Lucas et

al., 2021). But trunk extensor strength did not show a statistically significant change in ours. It reminds that the core muscles of the lower back and the hamstrings are noteworthy for their improvement before and after the BSP intervention.

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.

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 (Hock et al., 2022). 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.

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.

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.

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

Introduction

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 (Bandura et al., 1977. Jackson et al., 2014). 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 (Bandura et al., 1999). Because of the epidemiological elements of LBP, researchers have refined the studies in recent years. There are no large-scale bibliometric analyses of self-efficacy for LBP.

Bibliometrics is a quantitative method to analyze data and evaluate research (Bornmann et al., 2014). In numerous multidisciplinary investigations, tracking knowledge dissemination and utilizing cluster analysis can offer a thorough summary (You et al., 2021. Yu et al., 2020. Yu et al.,2021. Yu et al., 2021). 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 (Chen et al., 2006).

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.

Methods

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.

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.

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). 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 (Chen et al., 2010). Microsoft Excel 2019 was used for organizing the basic data. IBM SPSS 25.0 was used to conduct correlation analysis in the study.

Results and Discussion

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. There had 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 in the number of articles 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.

Analysis of Countries and Institutions

There were 103 regions identified in citing countries. 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 (Chen et al., 2010). 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, 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.

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 4 organizations with the same citation counts 8 followed (the Haukeland Hospital, Oxford University, the University of Washington, and Harvard University). It

showed 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. The 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.

Analysis of subject categories

After co-occurrence analysis, there were 93 WOS categories in 815 papers. Neurosciences & Neurology had the highest number of articles (215 records, 26.380%). Following were clinical neurology (197 records, 24.172%), rehabilitation (155 records, 19.018%), orthopedics (154 records, 18.896%), 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.

In the development of subject categories, five subjects have citation bursts in 1980-2021, 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.

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).

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

Analysis of Authors

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. 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). It indicated that these four authors were influential in developing research that derived LBP self-efficacy from other disciplines.

Analysis of References

The top 10 papers with the maximum citation counts are guidelines, medical devices, and systematic reviews. In terms of publication years, the earliest of them was published in 2006 (16 years ago). 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 were also these ten articles. Using index terms, "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. Research focusing on LBP self-management has grown in popularity since 2000.

Analysis of Terms and Keywords

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 (Sherman et al., 2005. Brox et al., 2003. Vide et al., 2013).

(2) Primary care: primary care is the first step before treatment begins. In LBP, a cognitive-behavioral program enhances self-care (Moore et al., 2000). Educational intervention programs combined with exercise also benefit primary care and self-management (Suni et al., 2006. Albaladejo et al., 2010).

(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 (Vide et al., 2013. Turner et al., 2016). Pain relief through pharmacological intervention therapy is helpful in chronic LBP (Steiner et al., 2011. Skljarevski et al., 2010).

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, guideline, and reliability would be potential forefronts in LBP self-efficacy research over the coming years.

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.

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.

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 (Cronbach's alpha =0.783) and a high construct validity level within five components: specialty medical initiative, self-processing methods, disease manifestation, anatomical knowledge, and identification. 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.

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; **<u>Zhe W</u>**; 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

<u>Zhe W</u>; 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

<u>**Zhe W**</u>; 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

<u>**Zhe W**</u>; 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

<u>**Zhe W**</u>; 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.

<u>**Zhe W**</u>, 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.

ISPOR Europe 2022 Conference "Collaborating Across Borders: Building & Using Evidence to Enable Access": Book of Abstracts

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

DOI: 10.1016/j.jval.2022.09.2451

Other abstracts

<u>**Zhe W**</u>.

Kinematics Characteristic of Lower Limbs in Patients with Non-contact Anterior Cruciate Ligament Reconstruction.

XXIII. Tavaszi Szél Konferencia 2020. Absztraktkötet : MI és a tudomány jövője.

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）

Beijing, China: People's Medical Publishing House Co., Ltd. (2021)
ISBN: 9787117297394

Zhe W; Ruiheng L; Mengqin S. (Translator)

Chapter 2, Chapter 4, Chapter 5, Chapter 7: Groin Strain, Shoulder, Calf & Shin, The Knee

The Soccer Injuries Guide - Chinese Edition （足球运动员伤病指南）

Beijing, China: Fiberead LLC (2021) p. 10 Paper: 13, 16 p