Cost- Effectiveness of Physiotherapy Interventions for Low-back Pain - A Systematic Review

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Abstract

Background: Due to the rapid increase in healthcare costs of low back pain (LBP), it is important to provide clinically and cost effective interventions to individuals with the condition.

Objective: To evaluate all recent economic evaluations of physiotherapy interventions for patients with LBP.

Data sources: Searches were undertaken on CINAHL, Medline, the National Health Service Economic Evaluation database (NHSEED), Health Technology Assessment (HTA), and Database of Abstracts of Review of Effects (DARE) from January 2008 to October 2018.

Study selection: Randomised controlled trials, cohort studies that assessed the cost-effectiveness of physiotherapy interventions on patients with LBP compared to a control group. A Consolidated Health Economic Evaluation Reporting Standards (CHEERS) checklist was used to assess the quality of the included studies.

Data extraction/Data synthesis: Pairs of review authors independently extracted data. A descriptive synthesis was conducted to summarise the data.

Results: A total of 1,531 articles were identified, and 11 studies fulfilled the inclusion criteria. The total number of participants included in the studies included in the review were 2,633 and their age ranged from 18 to 80 years. In the included studies, the duration of LBP ranged from 3 weeks to 1 year. Except in one study, all the included studies reported that physiotherapy intervention was cost effective compared to controls. Because of the heterogeneity of the included studies, meta-analysis was not possible.

Conclusion: Although most of the included studies suggested that physiotherapy interventions were cost effective, it is difficult to pool their cost effectiveness for a conclusive evidence.

Systematic review registration number CRD: 42018089773.

Keywords: Cost- effectiveness; Physiotherapy; Low back pain; Systematic review

What is already known on this topic: Interventions such as interdisciplinary rehabilitation, exercise, acupuncture, spinal manipulation, and cognitive behavioural therapy were shown to be cost-effective for patients with chronic LBP. As new physiotherapy interventions for LBP continue to emerge, it is important to examine the cost-effectiveness of these interventions.

What this review adds: Physiotherapy interventions such as advice on self-management, a novel motion sensor biofeedback treatment, individualised physical therapy plus advice and a brief telephone advice were shown cost-effective for LBP from health-care or societal perspective. Ten individual sessions and 20 group sessions which include exercise and behavioural principles were unlikely to be cost-effective from the societal perspective.

Introduction

Low-back pain (LBP) remains a global health problem, affecting most adults at some point during their lifetime [1]. Despite the variations among LBP epidemiological studies, those from developed countries showed that the lifetime, 1-year and a point prevalence of LBP ranges between 60% to 80%, > 50%, and 15% to 30%, respectively [2]. Compared to the general population of high-income countries, the prevalence or incidence of LBP is 2 – 4 times higher than the population of rural low-income countries [3]. Parallel to this, the estimate of the 1-year incidence of any episode of LBP ranged between 1.5% and 36% [1].]. LBP was responsible for around 60.1 million years lived with disability for all age groups globally in 2015, and there will be an overall increase in its global burden due to population increase and ageing [4]. Although health care for patients with LBP varies with providers offering therapies, the mean direct and indirect costs of LBP care are approximately twice as high for patients with chronic LBP compared to acutely ill patients [5]. In the United States alone the economic loss due to the condition has been estimated to be between US$100 to US$200 billion every year [6, 7]. The indirect costs of LBP account for more than 52% to 54% of its total cost. Also, approximately 25% of the direct costs of LBP are ascribed to physiotherapy interventions and rehabilitation [5]. Overall, LBP is one of the leading causes of high health care costs particularly in industrialised countries.

The National Institute for Health and Care Excellence (NICE) guideline on the management of LBP comprises a range of different interventions including physiotherapy interventions and medications [8]. Physiotherapy interventions such as advice and information, exercise programmes, and psychological therapies using cognitive behavioural approach are the mainstay management strategies for LBP. Evidence from randomised controlled trials demonstrated that physiotherapy interventions such as exercise therapy, behavioural and multidisciplinary interventions are effective in reducing pain intensity and disability [9,10]. However, as stated above, due to the nature of the condition its management is resource intensive.

Given the range of treatments or interventions for the management of LBP, it is important to consider the economic costs of physiotherapy interventions in allocating healthcare resources. Economic evaluations are tools that compare effects and costs of interventions with an alternative strategy from healthcare system, patient and societal perspective [11]. A healthcare system perspective is a point of view adopted when deciding to include treatment costs such as medical, non-medical costs associated with managing the disease such as costs of staff time, hospital admissions, and costs of managing adverse events caused by treatment in economic evaluation [11]. Whereas the adoption of societal perspective reflects a full range of social opportunity costs including, for example, the productivity losses arising from patients' inability to work [12]. Moreover, the diagnosis of LBP and subsequent related care including visits to physicians, medication, surgery and related treatments may also impose a financial burden specifically to patients and their families.

Economic evaluation as a tool, for example, aims to improve the efficiency of healthcare resources in relation to physiotherapy interventions [13]. In previous reviews [6], a guideline endorsing treatments of interdisciplinary rehabilitation, exercise, acupuncture, spinal manipulation, and cognitive behavioural therapy was shown to be cost-effective for patients with chronic LBP [14]. However, there is inconsistency and lack of evidence on the cost-effectiveness of some physiotherapy interventions including advisory consultation,

medications, massage and yoga or relaxation. In addition, the review is outdated as this was carried out over 10 years ago. As new physiotherapy interventions for LBP continue to emerge, it is important to examine the cost-effectiveness of these interventions. The purpose of the current review was to evaluate all recent economic evaluation studies of physiotherapy interventions for LBP.

Methods

Study Registration

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement [15].The systematic review was registered on PROSPERO database (International Prospective Register of Systematic Reviews), with registration number CRD: 42018089773.

Information Sources and Search

A literature search using Cumulative Index to Nursing and Allied Health Literature (CINAHL); MEDLINE; Database of Abstracts of Reviews of Effects (DARE); Health Technology Assessment (HTA); and the Centre for Reviews and Dissemination (CRD) databases was carried out from January 2008 to October 2018. The search terms used were back pain, low back pain, physiotherapy, health economics, economic evaluation, cost benefit analysis, cost effectiveness analysis, cost utility analysis, cost, expenditure, value, and money. These search terms were combined using conjunctions words such as ‘OR’ and ‘AND’. A systematic hand searching of citations referenced in articles and existing reviews was part of the overall search strategy. Two reviewers were independently involved in the literature search and any discrepancies were resolved by consensus or consultation with a third reviewer.

Eligibility Criteria

The criteria used for inclusion of studies were those that reported the effectiveness and cost of physiotherapy interventions provided by a physiotherapist; had abstracts published in

English; involved patients with LBP above the age of 18 years; and conducted in any geographical location. Systematic reviews, narrative literature reviews, conference papers, abstract and studies not yet fully completed were excluded.

Study Selection and Quality Assessment

Two researchers TG and FF were independently involved in the study selection and quality assessment. Any disagreement between the two review authors was resolved through discussion with a third reviewer (JMW). Title and abstracts that did not provide enough information regarding the eligibility criteria were considered for full-text evaluation and assessed if they met the inclusion criteria. Methodological quality of the included studies was assessed using the criteria listed in the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement [16]. Twenty-four items were addressed in six categories, which include title and abstract, introduction, methods, results, discussion, and others. Studies were labelled positive (√) if they reported in full, and negative (x) if they did not fulfil the listed criteria in the CHEERS statement. Those studies that had partial or inconclusive information were labelled as partial (P). A total score of 1 was assigned if they fulfilled the requirement of reporting for that Item completely, 0 for not reporting and 0.5 for partial reporting. The maximum score for an article that reported all information was 24, and cut-off point of score 75% was considered to assess the quality of the included studies by the researchers. Studies were determined to be of 'good quality' studies if they scored ≥ 75%; whereas studies were determined 'poor quality' studies if they scored < 75%. The total scores of the CHEERS statement are presented in a table.

Data Extraction

Two reviewers independently conducted the data extraction and resolved discrepancies by consensus or consultation with a third reviewer. The following characteristics of the studies were extracted: author, year of publication, number of participants, age, location, setting, duration of pain, type of interventions, comparator, outcome measures, primary and

secondary outcomes, time horizon, and costs, type and perspective of the economic evaluation, and study results.

Data Analysis

A descriptive synthesis was conducted to summarise the extracted results. No meta-analysis was carried out due to heterogeneity of the methodologies used for cost-effectiveness analysis of the included studies. In addition, many studies included in this systematic review did not report standard deviation of the mean effects and costs, thus preventing statistical pooling.

Results

Description of the Studies

The literature search identified 1,531 potential articles, of which 1,471 were found irrelevant after screening the titles and abstracts (Figure 1). The remaining 13 articles were assessed for inclusion by reading the full-text articles, and 11 of them were found eligible and were included for data synthesis.

----------Figure 1 about here----------

The scores of the methodological quality assessment based on the CHEERS criteria checklist are presented in Table 1. Five studies [20, 23, 24, 27, 28] achieved more than 75% of the CHEERs statement checklist criteria. The remaining six studies [18, 19, 21, 22, 25, 26] scored less than 75% of the criteria. All of the included studies contained the details of patient demographics, interventions, and comparator**.**

----------Table 1 about here----------

One of the included studies reported a cost-effectiveness of physiotherapy intervention on a population of pregnancy related LBP [19]. The remaining studies were targeted at employed and unemployed populations with specific or nonspecific LBP. The mean age of the populations within the studies ranged from 18 to 80 years, and duration of pain ranged from three weeks to 1 year. The geographical locations reported in the studies were Australia (n =

2), Brazil (n = 2), Canada (n = 1), Netherlands (n = 3), Israel (n = 1) Norway (n = 1), and United Kingdom (n = 1).

Economic Evaluation

The designs of the included economic evaluation studies were cost-effectiveness analysis (CEA) (n = 1) [19], cost-utility analysis (CUA) (n = 2) [20, 21] CEA and CUA (n = 7) [18, 23,22, 25, 27, 28, 26] and CUA, CEA and cost-benefit analysis (n = 1) [24]. The components of economic evaluation within the studies included were interventions, comparator, effects, costs, and results. The analysis of these components are outlined below.

Resources Used and Cost

The resources used and costs of the interventions and control varied according to the perspective adopted for the analysis. More than 70% of the included studies used a societal perspective [18, 19, 20, 22, 23, 24, 25, 28], and the remaining studies adopted the healthcare system perspective. The key resources used to assess the costs of physiotherapy interventions were medications (n = 11), consultation/advice (n = 11), hospitalisation (n = 3), and absenteeism from work (n = 8).

The costs of the interventions were valued using dollars ($), euro (€), pound sterling (£), and new shekel (NIS). Seven of the studies included estimated the costs of the interventions greater than the control arm. In all the included studies, the costs were estimated over a period of 12 months. The highest total mean of health-care cost (£421.52) per person in the intervention arm was reported in Norway [26]. Whereas, the lowest mean cost (£68.45) per patient was reported in the Netherlands [19]. The remaining four studies had lower cost estimate in the intervention arm than the control arm. For example, the mean costs (-$614 CI -$3133 to $255) of the intervention arm, include a brief telephone advice, a clinical consultation with a physiotherapist, and referral to a 6-month telephone-based health coaching per person was less than the control arm [28].

Effectiveness Measure and Outcomes

Pain intensity, general perceived effect, patient physical and mental function, fear of movement, disability, and health related quality of life were used to assess the health status of patients with LBP. Nine of the studies included reported the effects of physiotherapy interventions on patient disability and pain intensity; these were measured using the Roland-Morris LBP and Disability Questionnaire (RMDQ) and 11-point scale, respectively [23,20,22,19,25, 26, 27, 28, 18]. All the included studies reported that health related quality of life improved following physiotherapy interventions. However, two studies reported that the mean effectiveness of physiotherapy interventions was not significantly different compared to the control arm [19, 28]. For example, no difference was observed in quality adjusted life years (QALYs), disability, pain, body mass index (BMI) and weight between patients who received lifestyle intervention and usual are as control [28]. However, any small improvement of effectiveness from the intervention arm should always be compared to its increment of costs as this may affect the overall cost- effectiveness of the interventions.

Cost-effectiveness of Physiotherapy Interventions

All the studies included reported incremental cost effectiveness ratios (ICER) in terms of either cost/QALYs gained or cost per patient outcomes such as functional status, pain intensity, and disability (Table 2). All the included studies reported ICER in favour of physiotherapy intervention. One study [18] reported that physiotherapy intervention was not cost-effective; in this case the costs of physiotherapy intervention were similar to the control arm.

----------Table 2 about here----------

Discussion

The aim of this review was to examine the cost-effectiveness of physiotherapy interventions for LBP by synthesising information from recent cost-effectiveness studies. Our systematic review assessed 15 full-texted articles, and out of which 11 fulfilled the inclusion criteria. This is the first systematic review to examine the cost-effectiveness of physiotherapy interventions for LBP using CHEERS statement to evaluate the quality of studies included, all of which

scored above 50%. The included studies were conducted in Australia, Brazil, Canada, Netherlands, Norway, Israel and United Kingdom. The types of economic evaluation used in the included studies were CEA (n = 2), CUA (n = 2), CEA and CUA (n = 6), and CUA, CEA and cost-benefit analysis (n = 1), and the analysis was conducted over a period of six and twelve months. The perspectives adopted in the included studies were either societal or healthcare.

The key resources used to assess the costs of the physiotherapy interventions were medications, consultation/advice, hospitalization, and absenteeism from work. All the included studies reported that LBP patients improved their pain intensity, functional status, health related quality of life and disability with the physiotherapy interventions. However, two studies reported that the mean outcome measures such as health related quality of life, pain, disability, weight and body mass index of physiotherapy interventions were not significantly different compared to the control arm. Most of the studies included in the review also reported that the ICER was in favour of physiotherapy interventions; for example, physiotherapy interventions such as advice on self-management by physiotherapist, a novel motion sensor biofeedback treatment plus guidance-based care, individualised physical therapy plus advice, a brief telephone advice, physical activity in conjunction with physiotherapy, and cognitive based education programme were shown to be cost-effective for LBP either from the health-care or societal perspective. However, it is worth noting due to the variation of studies included such as the healthcare system, location, patient follow up, and the perspectives adopted, it is difficult to generalise the cost-effectiveness of physiotherapy interventions. In addition, the heterogeneity of the population included in the studies such as acute/chronic LBP, specific/non-specific LBP and pregnancy related LBP might make generalising the findings of the cost-effectiveness of physiotherapy interventions difficult.

Our findings were compared to those of previous review of cost-effectiveness physiotherapy interventions or treatments for low back pain [14]. Parallel to the findings of the current review, previous literature found evidence to support that interdisciplinary rehabilitation, exercise,

acupuncture, spinal manipulation, and cognitive behavioural therapy were cost-effective in patients with LBP. They also highlighted that there was insufficient and no evidence on the cost-effectiveness of advice and medications in the management of LBP. Due to the short time horizon used in the studies included in the present review it is difficult to determine the long-term costs and benefits of physiotherapy interventions. In addition, in the current review there was no evidence of cost-effectiveness of physiotherapy interventions from patient and/or caregivers perspective. Thus, it is important that the cost-effectiveness of the various forms of physiotherapy interventions are considered and conducted from the patient and caregivers perspective.

One of the major strengths of the current review was the use of an established quality assessment tool for the included studies. The application of the CHEERs checklist on the included studies showed poor reporting standard; for example, the majority of the included studies did not report the method used to estimate costs and sensitivity analysis. The uncertainty surrounding the results of cost-effectiveness analysis should be included in health economic studies [29]. Secondly, the conclusions are based on recent economic evaluations of physiotherapy interventions up to October 2018.

On the other hand, the conclusions of this review should be viewed with caution. To date there are many peer reviewed published studies showing that physiotherapy interventions are cost-effective for LBP; however, it is difficult to perform meta-analysis within this published literature. The main reason for this is that there was no uniformity of analysis on the costs and effects of the interventions within the cost effectiveness studies. For example, the resources used for the interventions were different across studies. In addition, there was no evidence on the long-term costs and effects of physiotherapy interventions. Thus, more studies examining the long-term clinical and cost-effectiveness of physiotherapy interventions in patients with LBP are needed. Moreover, more economic analysis examining physiotherapy interventions in real-world settings are required. This is because, patients with LBP in real world settings may receive multiple interventions simultaneously. Data on costs of physiotherapy

interventions in the individual studies included in this review might have changed. This means, the use of new data specifically on cost may change the cost-effectiveness of physiotherapy interventions. Lastly, there may be English language bias in this review as only studies published in English language were included. It is understood that cost-effectiveness studies may be highly influenced by the geographical locations where they are conducted, because, decision makers wanted them to be reported in their home language.

Overall, due to the above limitations, this systematic review has limited data synthesis, limited ability to generalise and compare the cost-effectiveness of physiotherapy interventions. It is difficult to provide a conclusive evidence. Future studies that compare directly the cost-effectiveness of two different clinically effective physiotherapy interventions or different doses within the same population would be helpful to evaluate the cost-effectiveness of physiotherapy interventions. Furthermore, to increase their relevance to decision makers and commissioners, future cost effectiveness analysis studies should provide the method used to measure healthcare resource use and costs, and sensitivity analysis.

Conclusion

The purpose of this review was to evaluate all recent economic evaluations of physiotherapy interventions. Our findings indicated that there was evidence to support that physiotherapy interventions were cost-effective; however, the cost-effectiveness of physiotherapy interventions was highly dependent on the type of intervention used in the control arm. The interventions used in the control arm within the current review included current physiotherapy guidelines or no-interventions. The presence of this kind of variation within the included studies has become a drawback not to pool the results of the cost-effectiveness studies. As a result, it is not possible to generalise the findings of cost-effectiveness of physiotherapy interventions. However, our findings may be important to clinicians and decision makers as they may help to improve the outcomes of physiotherapy for patients with LBP. Future cost-effectiveness studies are needed to examine the cost-effectiveness of physiotherapy interventions within

homogenous populations and studies that consider cost-effectiveness from the patient and caregiver perspective.

Contributors: FF and TG were involved in conceptualisation, design, data extraction and writing the manuscript. JMW was consulted as a third reviewer in the study selection and data extraction. FF, TG and JMW contributed to the critical review and approval of the final manuscript to submission.

Declaration of Interests: There are none.

Ethical Approval: Ethical approval was not required for this study as it was a systematic review based on published papers.

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References

1. Hoy D, Brooks P, Blyth F, Buchbinder R. The epidemiology of low back pain. Best practice & research Clinical rheumatology. 2010 Dec 1;24(6):769-81

2. Jonsson E, Nachemson AL. Neck and back pain: the scientific evidence of causes, diagnosis, and treatment. Lippincott Williams & Wilkins; 2000.

3. Volinn E. The epidemiology of low back pain in the rest of the world: a review of surveys in low-and middle-income countries. Spine. 1997 Aug 1;22(15):1747-54.

4. Kassebaum NJ, Arora M, Barber RM, Bhutta ZA, Brown J, Carter A, Casey DC, Charlson FJ, Coates MM, Coggeshall M, Cornaby L. Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet. 2016 Oct 8;388(10053):1603-58.

5. Becker A, Held H, Redaelli M, Strauch K, Chenot JF, Leonhardt C, Keller S, Baum E, Pfingsten M, Hildebrandt J, Basler HD. Low back pain in primary care: costs of care and prediction of future health care utilization. Spine. 2010 Aug 15;35(18):1714-20.

6. Katz JN. Lumbar disc disorders and low-back pain: socioeconomic factors and consequences. JBJS. 2006 Apr 1;88:21-4.

7. Rubin DI. Epidemiology and risk factors for spine pain. Neurologic clinics. 2007 May 1;25(2):353-71.

8. Bernstein IA, Malik Q, Carville S, Ward S. Low back pain and sciatica: summary of NICE guidance. BMJ. 2017 Jan 6;356:i6748.

9. Van Middelkoop M, Rubinstein SM, Kuijpers T, Verhagen AP, Ostelo R, Koes BW, van Tulder MW. A systematic review on the effectiveness of physical and rehabilitation interventions for chronic non-specific low back pain. European Spine Journal. 2011 Jan 1;20(1):19-39.

10. Storheim K. Targeted physiotherapy treatment for low back pain based on clinical risk can improve clinical and economic outcomes when compared with current best practice. Journal of physiotherapy. 2012 Mar 1;58(1):57.

11. Drummond MF, Drummond MF, McGuire A. Economic evaluation in health care: merging theory with practice. OUP Oxford; 2001.

12. Bock JO, Brettschneider C, Seidl H, Bowles D, Holle R, Greiner W, König HH. Calculation of standardised unit costs from a societal perspective for health economic evaluation. Gesundheitswesen (Bundesverband der Arzte des Offentlichen Gesundheitsdienstes (Germany)). 2015 Jan;77(1):53-61.

13. Weinstein MC, Siegel JE, Gold MR, Kamlet MS, Russell LB. Recommendations of the Panel on Cost-effectiveness in Health and Medicine. Jama. 1996 Oct 16;276(15):1253-8.

14. Lin CW, Haas M, Maher CG, Machado LA, van Tulder MW. Cost-effectiveness of guideline-endorsed treatments for low back pain: a systematic review. European Spine Journal. 2011 Jul 1;20(7):1024-38.

15. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Annals of internal medicine. 2009 Aug 18;151(4):264-9.

16. Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E. Consolidated health economic evaluation reporting standards (CHEERS) statement. Cost Effectiveness and Resource Allocation. 2013 Dec;11(1):6.

17. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Annals of internal medicine. 2009 Aug 18;151(4):264-9.

18. van der Roer N, van Tulder M, van Mechelen W, de Vet H. Economic evaluation of an intensive group training protocol compared with usual care physiotherapy in patients with chronic low back pain. Spine. 2008 Feb 15;33(4):445-51.

19. Bastiaenen CH, de Bie RA, Vlaeyen JW, Goossens ME, Leffers P, Wolters PM, Bastiaanssen JM, van den Brandt PA, Essed GG. Long-term effectiveness and costs of a brief self-management intervention in women with pregnancy-related low back pain after delivery. BMC pregnancy and childbirth. 2008 Dec;8(1):19.

20. Haines T, Bowles KA. Cost-effectiveness of using a motion-sensor biofeedback treatment approach for the management of sub-acute or chronic low back pain: economic evaluation alongside a randomised trial. BMC musculoskeletal disorders. 2017 Dec;18(1):18.

21. Hahne AJ, Ford JJ, Surkitt LD, Richards MC, Chan AY, Slater SL, Taylor NF. Individualized Physical Therapy Is Cost-Effective Compared With Guideline-Based Advice for People With Low Back Disorders. Spine. 2017 Feb 1;42(3):E169-76.

22. Werner EL, Storheim K, Løchting I, Wisløff T, Grotle M. Cognitive patient education for low back pain in primary care: a cluster randomized controlled trial and cost-effectiveness analysis. Spine. 2016 Mar 15;41(6):455-62.

23. Miyamoto GC, Franco KF, van Dongen JM, dos Santos Franco YR, de Oliveira NT, Amaral DD, Branco AN, da Silva ML, van Tulder MW, Cabral CM. Different doses of Pilates-based exercise therapy for chronic low back pain: a randomised controlled trial with economic evaluation. Br J Sports Med. 2018 Jul 1;52(13):859-68.

24. Lambeek LC, Bosmans JE, Van Royen BJ, Van Tulder MW, Van Mechelen W, Anema JR. Effect of integrated care for sick listed patients with chronic low back pain: economic evaluation alongside a randomised controlled trial. Bmj. 2010 Dec 1;341:c6414.

25. Herman PM, Szczurko O, Cooley K, Mills EJ. Cost-effectiveness of naturopathic care for chronic low back pain. Alternative Therapies in Health & Medicine. 2008 Mar 1;14(2).

26. Lamb SE, Hansen Z, Lall R, Castelnuovo E, Withers EJ, Nichols V, Potter R, Underwood MR, Back Skills Training Trial investigators. Group cognitive behavioural treatment for low-back pain in primary care: a randomised controlled trial and cost-effectiveness analysis. The Lancet. 2010 Mar 13;375(9718):916-23.

27. Canaway A, Pincus T, Underwood M, Shapiro Y, Chodick G, Ben-Ami N. Is an enhanced behaviour change intervention cost-effective compared with physiotherapy for patients with chronic low back pain? Results from a multicentre trial in Israel. BMJ open. 2018 Apr 1;8(4):e019928.

28. Williams, A., van Dongen, J.M., Kamper, S.J., O'Brien, K.M., Wolfenden, L., Yoong, S.L., Hodder, R.K., Lee, H., Robson, E.K., Haskins, R. and Rissel, C., 2018. Economic evaluation of a healthy lifestyle intervention for chronic low back pain: a randomised controlled trial. bioRxiv, p.296285.

29. Pignone M, Saha S, Hoerger T, Lohr KN, Teutsch S, Mandelblatt J. Challenges in systematic reviews of economic analyses. Annals of internal medicine. 2005 Jun 21;142(12_Part_2):1073-9.

Figure

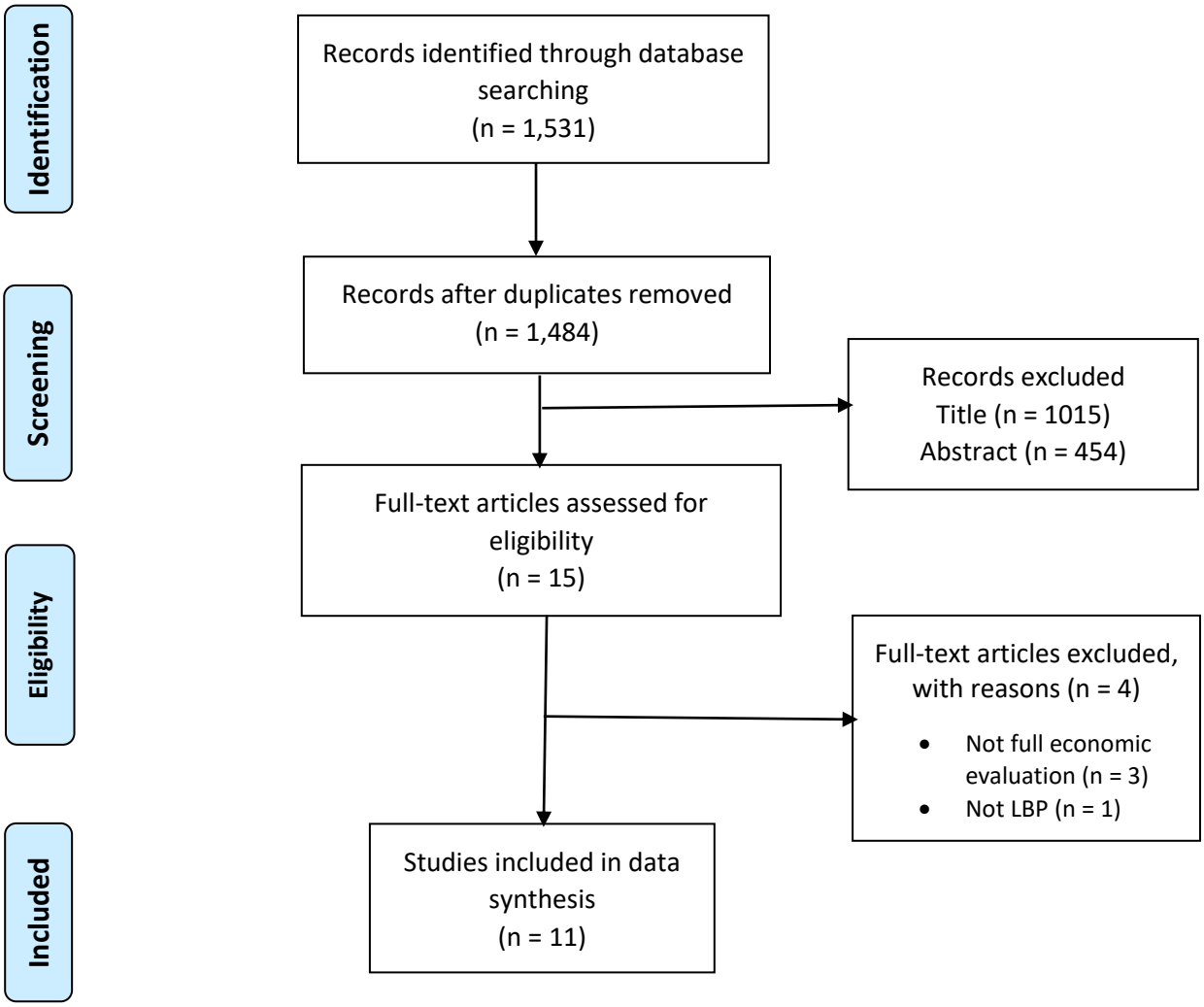

Figure 1. The preferred reporting for systematic review diagram representing the systematic literature search [17].

Table

Table 1: Methodological quality assessment of studies using the CHEERs statement

Study	Score (/24)
Van der Roer 2008 [18]	16.5
Bastiaenen 2008 [19]	17
Haines 2017 [20]	19
Hahne 2017 [21]	16
Werner 2016 [22]	16
Miyamoto 2018 [23]	19
Lambeek 2010 [24]	18
Herman 2008 [25]	16.5
Lamb 2010 [26]	14
Canaway 2018 [27]	18
Williams 2019 [28]	19

Table 2: Description of studies on the cost-effectiveness of physiotherapy interventions for the management of LBP

Study/Location/Study design/Time-horizon	Target population	Intervention	Control	Outcomes/ Measurement used	Type of cost/ Perspective	Costs (per participant)/ Effectiveness/ ICER
Van der Roer 2008 [18], Netherlands/ CEA and CUA/ 1-Year	#114 (18 to 65 years) with chronic nonspecific LBP. Pain duration > 12 weeks.	Ten individual sessions and 20 group sessions. These training sessions were provided by a physiotherapist. It include exercise and behavioural principles.	Usual care	Pain intensity score/11-Point numerical scale General perceived effect/6-Point scale Patients functional status/RMDQ Quality of life/Euro-Qol	Direct costs, Indirect costs/ Societal	**Costs** €233 [95% CI -2185; 2764] higher for Int. **Effectiveness** Int. gained 0.06 points [95% CI:−2.22; 2.34] for function; −1.02 points [95% CI:−2.14; 0.09] pain intensity and 0.03 [95% CI−0.06; - 0.12] QALYs. **ICER** € 5141/QALY gained. Int. not cost- effective
Bastiaenen 2008 [19], Netherlands/ CEA/ 1-Year	#126 women (> 18 years) with non -specific pregnancy related LBP (3 weeks after delivery)	Advice on self-management by a physiotherapist (a brief self – management).	Patients were permitted to choose any physiotherapy.	Physical and mental function / RMDQ Global Perceived effect/ 7-Point scale; Pain intensity/VAS Fear of movement/Tempa scale Health status/SF - 36 and EQ - 5D	Direct costs Indirect costs/ Societal	**Costs** €-4341 [95% CI -8850;167] higher for Int. **Effectiveness** RDQ* = -1.6 [-2.9; -0.5]; IPA$^{\alpha}$ = = -1 [-1.9; -1.1]; TSK** = -2.4 [-3.8; -1.1] gained for Int. **ICER** Both effectiveness and costs were in favour of the intervention. Int. cost- effective
Haines 2017 [20], Brazil/CUA/ 1-Year	#296 patients (18 to 65 years) with non-specific LBP. Pain duration at least 3 weeks.	A novel motion-sensor biofeedback treatment plus guidelines-based care. The intervention was provided by a physiotherapist.	Combination of education and advice, exercises, imaging, manual therapy, and medication.	Fear of movement/Fear avoidance belief questionnaire Pain intensity/Quadruple VAS Disability/RMDQ Physical and mental function/Patient specific functional scale	Direct costs, Indirect costs/ Societal	**Costs** $477 higher medical and therapy for Int. $-53 lower use of non-trial medical and therapy for Int. $-5123 higher improvement in productivity for Int. **Effectiveness** Favoured the intervention. **ICER** Not reported Int. cost- effective
Lamb 2010 [26], UK/ CEA,CUA/ 1-Year	#701 (> 54 years) with subacute or chronic LBP. Pain duration at least 6 weeks.	Individual assessment for up to 1.5 hour duration, and six sessions of group therapy up to 1.5 hour duration each plus advice. Intervention provided by a physiotherapist.	Active management advice for a 15 minute session.	Back pain disability/RMDQ Mental and physical health-related quality of life/Euro-Qol.	Direct costs/ Healthcare	**Costs** £170.7 higher for Int. **Effectiveness** 0.099 QALY gained for Int. **ICER** £1,786/QALY gained. Int. Cost- effective

*Change in limitations in activities (RDQ); $^{\alpha}$ Impact on participation and autonomy; **Pain related fear; Roland Morris Disability Questionnaire= RMDQ; CUA = Cost utility analysis; CEA = Cost effectiveness analysis; QALY = Quality adjusted life years; CBA = Cost benefit analysis; Qol = Quality of life; Incremental cost-effectiveness ratio = ICER; Int = Intervention; Cot = Control

Table 2 (Cont.): Description of studies on the cost-effectiveness of physiotherapy interventions for the management of LBP

Study/Location/ Study design/ Time-horizon	Target population	Intervention	Control	Outcomes/ Measurement used	Type of cost/ Perspective	Cost (per participant)/ Effectiveness/ ICER
Canaway 2018 [27], Israel/ CEA & CUA/ 1-Year	#220 (25 to 55 years) with chronic LBP. Pain duration three months.	A model of behaviour change aimed to increase the adherence and implementation of physical activity in conjunction with physiotherapy. Intervention delivered by a physiotherapist.	Standard physical therapy (mobilisation, manipulation, back exercise, postural training, attending back school, electrical stimulation)	Short Form Survey (SF-12) / Euro-Qol Disability / RMDQ[α]	Direct cost/ Healthcare	**Costs** NIS230 [95% CI NIS85; NIS375] higher for Int. **Effectiveness** Intervention arm increased from 0.66 to 0.79 (utility). Control improved from o.62 to 0.74 (utility) Intervention arm improved from 9.95 to 3.27 (RMDQ) Control arm improved from 10.24 to 5.97 (RMDQ) **ICER** Not reported Int. cost- effective
Hahne 2017 [21], Australia/ CUA/ 1-Year	#300 (18 to 65 years) with LBP. Pain duration 6 weeks to 6 months.	Individualized physical therapy plus advice (10 x 30 minute advice sessions over ten-weeks period) and was delivered by a physiotherapist.	Guideline-based advice alone (2 X 30-minute advice sessions over a 10 weeks period)	Health related quality of life / Euro - Qol	Direct cost/ Healthcare	**Costs** $27 [95% CI:-200; 254] higher for Int. **Effectiveness:** 0.06 [95% CI: 0.02; 0.10] QALY gained for Int. **ICER** $422 per QALY gained Int. cost- effective
Werner 2016 [22], Norway/CEA/1-Year	#216 (20 to 55 years) with unspecific LBP. Pain duration 4 weeks to 1 year.	Cognitive- based education program provided by general practitioner and a physiotherapist.	Patients were meant to meet with their provider for four 30-minute one-to-one sessions during a 4-week period.	Physical and mental function/RMDQ[α] Back pain intensity/ 11-Point numerical scale Health related quality of life /Euro-Qol-5D	Direct cost, Indirect cost/ Societal	**Costs** $79 higher for Int. **Effectiveness** RMDQ[α] points = 0.7 [95% CI -0.6; 1.9] higher for Int. 0.01 [0.02; 0.03] QALY gained from Cot **ICER** Not reported Int. cost- effective
Herman 2008 [25],Canada/ CEA & CUA/ 1-Year	#70 (18 to 65 years) with LBP. Pain duration of at least 6 weeks.	Naturopathic care: acupuncture, exercise and dietary advice, relaxation training, and back care educational booklet. Intervention delivered by a physiotherapist.	Standardized physiotherapy advice and the back care educational booklet	Health related quality of life/ RMDQ[α], Oswestry Disability Index (ODI); VAS	Direct cost Indirect cost/ Societal	**Costs** $1212 lower for Int. **Outcome** 0.03 [95% CI: 0.01; 0.04] QALY gained for Int. **ICER** Not reported Int. cost- effective

[α] Roland Morris Disability Questionnaire; CUA = Cost utility analysis; CEA = Cost effectiveness analysis; CBA = Cost benefit analysis; VAS = Visual analogue scale; Qol = Quality of life; QALY = Quality adjusted life years; Incremental cost-effectiveness ratio = ICER;NIS = New Israeli shekels; Int = Intervention; Cot = Control

Table 2 (Cont.): Description of studies on the cost-effectiveness of physiotherapy interventions for the management of LBP

Study/Location/ Study design/ Time horizon	Target population	Intervention	Control	Outcomes/ Measurement used	Type of cost/ Perspective	Costs (per participant)/ Effectiveness/ ICER
Miyamoto 2018 [23], Brazil/ CUA & CEA/ 1-Year	#296 (18 to 80 years) with non-specific chronic LBP. Pain duration three months.	Pilates group (PG):Individual exercise including ground exercises and apparatus exercise was delivered by a physiotherapist. Pilates group 1 (PG1)- received treatments once a week (6 treatment sessions); Pilates group 2 (PG2)- twice a week (12 treatment sessions); Pilates group 3 (PG3)-three times a week (18 treatment sessions).	Booklet group (BG): contained recommendations related to posture and movement of activities of a daily living, information on LBP and anatomy of the spine and pelvis.	Pain intensity/11-Pont numerical rating scale Disability/RMDQ[α] Global perceived effect/Global perceived effect scale	Direct cost Indirect cost/ Societal	**Costs** Costs per patient were £0.3 for BG, £171 for PG1, £331 for PG2 and £469 for PG3. **Effectiveness** Pain intensity, PG1, MD = −1.2, [95%CI −2.2 to −0.3] higher from BG; PG2, MD= −2.3 [95%-3.2 to -1.4] higher from BG; and PG3, MD = -2.1 [95%CI −3.0 to −1.1] higher from BG. Disability, PG1, MD = −1.9, [95%CI −3.6 to −0.1] higher from BG; PG2, MD = −4.7 [95% CI −6.4 to −3.0] higher from BG; PG3, MD = −3.3, [95%CI −5.0 to −1.6] higher from BG. **ICER** Not reported PG3 cost-effective.
Williams 2019 [28], Australia/ CUA & CEA/ 6 -Months	#160 (≥ 18 years) with chronic LBP, overweight or obese. Pain duration > 3 months.	A brief telephone advice, a clinical consultation with a physiotherapist, and referral to a 6-month telephone-based health coaching.	No restrictions were placed upon participant's use of other health services during the study period.	Health related quality life/SF-12 Pain intensity/0 to 10 Point numerical rating scale (NRS), Disability/RMDQ[α] Weight and BMI/Kilogram (Kg) and Kg/m²	Direct cost Indirect cost/ Societal	**Costs** $292 higher for Int. **Effectiveness** 0.02 QALY gained for Int. **ICER** -$31,087 /QALY gained Int. cost-effective
Lambeek 2010 [24], Netherlands/ CEA & CUA, CBA/ 1-Year	#134 (18 to 65 years) with chronic LBP. Pain duration 12 weeks.	Graded activity (GA) which is a time contingent programme based on cognitive behavioural principles and work place intervention. Intervention delivered by a physiotherapist, medical specialist and clinical occupational physician.	Advice provided by general practitioners and occupational physicians based on the Dutch guideline.	Duration until sustainable return to work/Sick leave due to low back pain in calendar days Health related quality of life/ Euro Qol	Direct cost Indirect cost/ Societal	**Costs** £5310.0 lower from Cot. **Effectiveness** 0.09 QALY gained for Int. **ICER** -61000.0 / QALY gained. Int. cost-effective

[α] Roland Morris Disability Questionnaire; CUA = Cost Utility Analysis; CEA = Cost Effectiveness Analysis; CBA = Cost Benefit Analysis; MD = Mean difference; Qol = Quality of life; QALY = Quality adjusted life years; Incremental cost-effectiveness ratio = ICER; Int = Intervention; Cot = Control

Appendix

Table 1: Search terms used in the databases

Search ID#	Search Terms
S15	S3 AND S13 AND S14
S14	S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S11 OR S12
S13	S1 OR S2
S12	Money
S11	Value
S10	Expend*
S9	Cost
S8	Cost utility analysis
S7	Cost effective analysis
S6	Cost benefit analysis
S5	Economic evaluation
S4	Health economics
S3	Phys*
S2	Back pain
S1	low back pain