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REVIEW

A Systematic Review on Health Economic Evaluations of Telerehabilitation for Chronic Spinal Pain

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Background: Telerehabilitation can improve clinical outcomes by increasing access to and adherence to rehabilitation protocols, leading to favourable benefits in overall quality of life at a reasonable cost. This systematic review aims to conduct a thorough analysis of published health economic evaluations of standalone telerehabilitation interventions for individuals with chronic spinal pain, focusing on reported costs and clinical outcomes.

Methods: An extensive search was conducted in English across four general medical databases and three health economic databases. The studies' quality was evaluated using the updated Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement.

Results: Five economic evaluations were identified, comprising three high-quality and two medium-quality studies. Among these studies, four indicated that telerehabilitation interventions were more cost-effective than standard treatment and conventional physical therapy from a social and healthcare perspective. The sixth study, which lacked a comparison group, also demonstrated that the use of remote follow-ups and programming for Spinal Cord Stimulation (SCS) devices in chronic spinal pain is cost-effective.

Conclusion: Telerehabilitation, particularly telerehabilitation-based McKenzie therapy (TBMT), may represent the most economically efficient approach compared to conventional treatment interventions for individuals with chronic lumbar spine pain. For a more robust conclusion, it is imperative to conduct comprehensive economic evaluations using larger sample sizes over extended periods across multiple countries.

Keywords: chronic spinal pain, low back pain, health economic evaluation, telerehabilitation, telerehabilitation-based McKenzie therapy

Introduction

Chronic spinal pain, which is associated with disorders affecting the cervical, thoracic, and lumbar regions of the spine[1] and persists for more than three months,[2] constitutes a major global public health issue.[3] It significantly contributes to adult disability worldwide.[1] This ailment not only reduces the quality of life of a significant population but also imposes a significant financial burden on healthcare systems due to longer treatment and reduced productivity.[4]

The prevalence of chronic spinal pain varies depending on the particular region of the spine affected. Notably, lower back pain, the most prevalent form of spinal pain,[3] stands as the second most common reason for consulting medical services in primary care settings.[5] An international comprehensive analysis (n = 28 studies) reveals a direct relationship between age and the prevalence of chronic low back pain (CLBP). The prevalence was 4.2% among those aged 24 to 39 years old and 19.6% among those aged 20 to 59.[6] Chronic spinal pain also has a significant global economic impact as well. A comprehensive review and meta-analysis covering America, Europe, and the Western Pacific regions revealed

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that the estimated direct and total costs associated with lumbar pain per patient amount to USD 9231 and USD 10,143, respectively.[4]

The management strategies for chronic spinal pain include pharmacological treatment, surgical procedures, or rehabilitation.[7] Rehabilitation is a non-pharmacological strategy employed to reduce pain and improve the functional capacity of patients with chronic spinal pain.[8] This rehabilitation is crucial in order to reduce the significant medical and social costs associated with chronic spinal pain.[9] While in clinical practice, rehabilitation is typically administered through conventional in-person interactions. However, in recent times, telerehabilitation has emerged as a promising substitute for conventional in-person rehabilitation.[10] It refers to the provision of comprehensive rehabilitation services remotely, utilizing telecommunications technology as the medium for delivery.[11] Telerehabilitation can enhance clinical outcomes by improving access to and compliance with rehabilitation protocols, resulting in positive effects on physical and mental functions as well as overall quality of life.[10] Furthermore, the epidemic of coronavirus disease in 2019 (COVID-19) has also demonstrated the substantial impact of telerehabilitation in enhancing treatment accessibility, particularly in remote regions and situations when personal presence is unfeasible.[12]

Regarding the economic efficiency of telerehabilitation for various chronic conditions, variable types of findings are observed in the previous studies. In a systematic review (n = 8 studies) on neurological illnesses, four studies collectively reported statistically significant cost savings per individual ranging from $565.66 to $2352.00 ($p < 0.05$). However, majority of included studies have identified disparities in both costs and clinical outcomes between telerehabilitation and face to face rehabilitation.[13] In another systematic review that included five health economics studies on musculoskeletal disorders, telerehabilitation was found to be $89.55 less expensive per person compared to conventional therapy.[14]

While health economic analyses are key for decision-makers to effectively distribute resources and enhance health results,[15] the expanding practice of telerehabilitation for chronic spinal pain faces a shortfall in thorough economic evaluations. This systematic review aims to fill this gap by conducting an in-depth analysis of health economic evaluations of standalone telerehabilitation interventions for chronic spinal pain, with an emphasis on reported costs and clinical outcomes.

Methodology

Search Strategy

A comprehensive examination of scientific literature without any time restrictions was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards.[16]

The literature review encompassed a total of seven databases, covering the period from inception up to 2024. The databases included were PubMed, Google Scholar, Cochrane Central Register of Controlled Trials, Health Technology Assessment (HTA), Cost-Effectiveness Analysis (CEA) registry, the National Health Service Economic Evaluation Database (NHS EED), and ScienceDirect. Furthermore, a bibliographic search was performed on recent pertinent journal articles, systematic reviews, and meta-analyses.

The search was conducted using keywords such as “health economics”, “chronic spinal pain”, and “telerehabilitation” by two authors, with any discrepancies resolved through discussion. After duplicates were removed, titles, abstracts, and full-text articles were evaluated to exclude studies that did not meet the inclusion criteria. The search strategies employed for each database and the number of results obtained are shown in Supplementary Table 1.

Selection of Studies

The criteria for inclusion of studies in this systematic review were determined based on the PICOS (population, intervention, comparison, outcomes, and study design) framework.

Population: This includes individuals who have been diagnosed with chronic spinal pain lasting more than 3 months,[2] regardless of the underlying illness. The study includes patients who are 18 years or older without any restrictions based on gender, level of pain, diagnostic criteria, or presence of other conditions.

Intervention: The intervention of interest is standalone telerehabilitation, which has undergone thorough a comprehensive evaluation with respect to both the clinical benefits and the associated cost, with no restrictions on the content or method of delivery, or the type of therapeutic approach.

Comparator (C): This involves comparing it to traditional in-person rehabilitation or with no comparator.

Outcome (O): The outcomes are health economic indicators such as the Incremental Cost-Effectiveness Ratio (ICER), cost-benefit ratios, and Incremental Cost-Utility Ratio (ICUR). Furthermore, this study encompasses clinical outcomes associated with the management of chronic spinal pain, such as the amelioration of pain, improvement in physical activity, and effect on overall quality of life.

Study Design (S): The included studies consist full health economic evaluations published in English language only, with a specific emphasis on cost-effectiveness and cost-utility studies.

Excluded from consideration were comments, letters, news pieces, editorials, correspondence, narratives, systematic reviews, case studies, study procedures, and articles that were not original or published in non–peer-reviewed journals. Furthermore, any research that solely examined the assessment of disease costs, cost minimization analysis, or partial economic evaluations were not included. In addition, the studies focused mainly on the health economic evaluation of screening or diagnostic technologies were also excluded.

Data Extraction and Quality Appraisal

Each author of the study actively participated in evaluating the process of selecting studies, assessing their quality, and extracting data. The uniform data form was utilised to collect detail information, including the name of the first author, country and year of the study, study design, sample size and demographics, specific type of chronic spinal pain and underlying cause, diagnostic criteria employed, type and detail of intervention and comparator, cost perspective, currency, discount rate, relevant clinical outcomes, associated costs, health economic outcome, limitations, conclusions, and funding details for each study.

The updated CHEERS (Consolidated Health Economic Evaluation Reporting Standards) statement was used to evaluate the quality of the included economic assessments. The updated CHEERS statement can effectively incorporate a wide range of health economic evaluations, novel methodologies, and advancements in the area.[17] It consists of 28 items that cover various aspects of economic evaluations. Each item was evaluated to see if a study completely met the standards, failed to meet the criteria, or was not relevant. Studies that attained a compliance rate of 100% were deemed to possess excellent quality. Likewise, studies that followed 75% to 99% of the criteria were categorised as high quality, but those that met 50% to 74% of the criteria were considered to have medium quality. A compliance rate below 50% signifies a low level of quality.

Data Synthesis

The data obtained from the studies included in the analysis were presented through a combination of narrative synthesis and structured tables. This approach is consistent with the recommendations for producing concise and informative summaries of health economic research, as specified in the Cochrane Handbook for Systematic Reviews.[18]

In order to enable comparisons between studies undertaken in different nations, all expenses were converted from their native currencies and pricing years to United States dollars ($) for the year 2024. The conversion was conducted using methods established by the Campbell and Cochrane Economics Methods Group and the Evidence for Policy and Practice Information and Coordinating Centre.[19] Supplementary Table 2 contains comprehensive data on the initial costs and their conversion to US dollars ($).

Results

Literature Search

A total of 538 studies were found through the search of eight databases. After removing 277 duplicates, 261 studies remained for title and abstract screening. Among these, 192 studies were excluded for various reasons detailed in Figure 1. Of the 69 full-text studies remaining, 65 studies were excluded as 26 were focused solely on clinical outcomes,

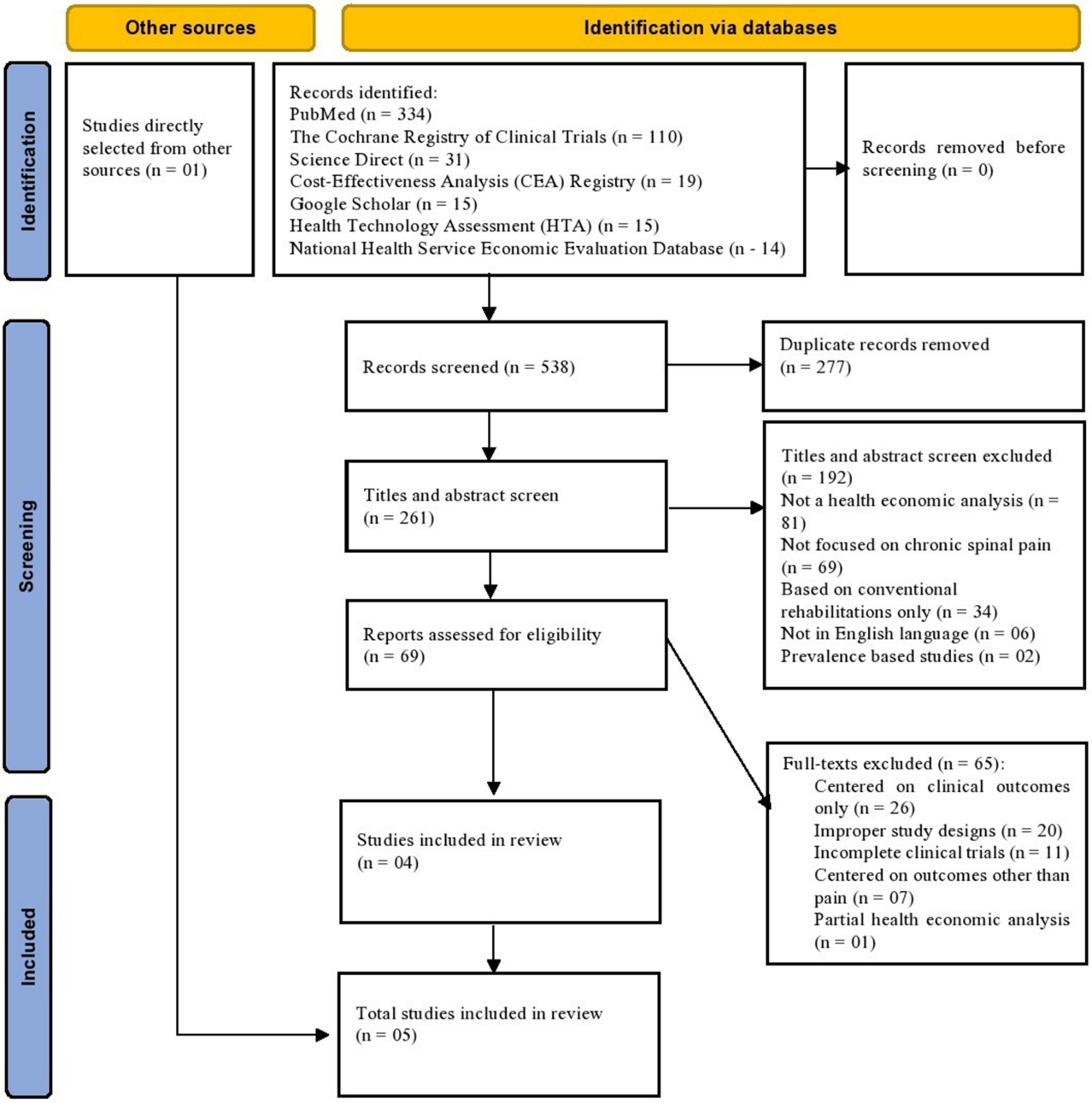

Figure 1 PRISMA flowchart of the searching and screening studies.
Notes: Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group* t. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Annals of internal medicine. 2009;151(4):264–269.[16]

20 had inappropriate research designs, 11 were incomplete clinical trials, 7 addressed outcomes other than pain, and 1 included only partial health economic analysis. Ultimately, four articles were chosen for final analysis.[20–23] Additionally, one study was directly sourced[24] resulting in selection of total five studies.

Quality Assessment of Included Studies

In the included studies, three out of five investigations scored between 75% and 99% on the updated CHEERS assessment criteria,[20–22] demonstrating a high level of quality. Two studies scored 62.5% and 50%, respectively,[23,24] and were categorised as having a medium quality.

Table 1 Assessment of Health Economic Studies on Telerehabilitation Strategies for Chronic Spinal Pain Based on the Updated Consolidated Health Economic Evaluation Reporting Standards (CHEERS) Statement

Study	CHEERS Items Satisfied	CHEERS Items not Satisfied	Relevant CHEERS Items	Percent (%) Satisfied	Quality
Park et al, 2023[23]	15	9	24	62.5	Medium
Lewkowicz et al, 2022[22]	23	4	27	85	High
Fatoye et al, 2022[20]	18	6	24	75	High
Han et al, 2021[24]	12	12	24	50	Medium
Fatoye et al, 2019[21]	18	6	24	75	High

Note: Supplementary Table 3 provides a comprehensive quality assessment of the studies included, following the updated CHEERs statement.

Since we employed the updated CHEERS tool statement released in 2022,[17] it's worth noting that none of the included studies met all of the newly introduced criteria. These criteria encompassed analyzing distributional implications, adopting a strategy to engage patients and other relevant individuals, and assessing the impacts of involving patients and other affected parties. Furthermore, none of the studies provided details on the development of a health economic analysis plan, which was a component of both the old and updated statements.

There were some items that were not relevant to the majority of the chosen studies. For instance, due to the short time horizon in most investigations, the discount rate was only applicable in one out of the six studies.[22] Additionally, because an economic model was used in only one study,[22] two criterion concerning modelling was not applicable to the other chosen studies. Furthermore, none of the individual studies performed a subgroup analysis, therefore preventing the application of criteria for characterising heterogeneity. The evaluation of the quality of included studies is presented in Table 1, with a more comprehensive analysis available in Supplementary Table 3.

Baseline Characteristics

The included two studies were undertaken in Nigeria,[20,21] while other studies were each conducted in South Korea,[23] Germany,[22] and China.[24] All investigations were conducted using RCTs, except for one which employed an economic model.[22] Similarly, all the studies focused on patients with chronic lower back pain only, predominantly of nonspecific origin.

The selected studies included 358 patients, with an average age of 46.7 years. Gender was reported in only three studies, with 41.9% of participants being women.[23,24] Most of the chosen studies (n = 4) utilised experimental intervention of telerehabilitation that was centered on a mobile app.[21–24] The remaining one study focused on an interactive video game.[20] The comparator group in these studies received Clinic-based McKenzie Therapy (CBMT)[20,21] and treatment as usual[22] in one study. One study employed the comparator group of conventional physical therapy,[23] while the remaining one study did not have any comparison group.[24] The time frame of the interventions ranged from 4 weeks to 3 years, with a discount rate of 3% applied in a single study.[22] Three studies employed a healthcare perspective, which emphasizes costs directly linked to healthcare services.[20,21,23] One study adopted a societal perspective, considering broader economic consequences, including productivity loss.[22] The remaining one study utilized a patient perspective, focusing on the costs and benefits from the individual's viewpoint[24] respectively. The baseline characteristics of the studies are presented in Table 2.

The included studies examined many cost categories, including direct medical costs, direct non-medical costs, and indirect costs. Direct intervention costs were reported in 80% of the included studies, followed by outpatient care and transportation expenses in 60%. Similarly, cost related to diagnostic/lab services, medications and productivity losses had the lowest reported rate of 20%. The cost breakdown detailed in the studies is shown in Table 3.

Quality-Adjusted Life Years (QALY) was the primary evaluated clinical outcome in four out of five selected studies. The QALY in these studies was assessed using the questionnaires tools of SF-6D,[20,21] German version of the Veterans

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Table 2 Methodological Characteristics of Health Economic Studies on Telerehabilitation Strategies for Chronic Spinal Pain

Study	Study Type and Country	Type of Chronic Spinal Pain	Sample	Interventions	Telerehabilitation Details	Perspective	Time Horizon	Discount Rate
Park et al, 2023[23]	RCT; South Korea	LBP: 40% discogenic and 60% nonspecific, 7.8 months duration	n = 100; age 35.5 years; 40% women	Digital Application Physical Therapy versus Conventional Physical Therapy	Included the use of the Dr. AI app for evaluation, monitoring, diagnosis, and intervention.	Healthcare	04 weeks	NA
Lewkowicz et al, 2022[22]	Model based on RCT; Germany	Non-specific LBP	n = 101; age 41 years	Digital Therapeutic Care App versus Treatment as Usual (TAU)	Involves a digital app providing personalized decision-support for managing LBP.	Societal	03 years	3%
Fatoye et al, 2022[20]	RCT; Nigeria	Non-specific LBP	n = 46; age 48.2 years	Back Extension-Virtual Reality Game (BE-VRG) versus Clinic-based McKenzie Therapy (CBMT)	Involved an interactive video game designed to simulate therapeutic back extension exercises.	Healthcare	08 weeks	NA
Han et al, 2021[24]	Observational study; China	Intractable spinal pain treated with Spinal Cord Stimulation (SCS)	n = 64; age 58.6 years; 43.8% women	Remote follow-ups and programming for SCS devices	A remote system that allows physicians to program the SCS system remotely. Patients and physicians could interact via a dedicated application, enabling remote consultations, programming adjustments, and symptom management.	Patient	01 year	NA
Fatoye et al, 2019[21]	RCT; Nigeria	Non-specific LBP	n = 47; age 48.65 years	Telerehabilitation-Based McKenzie Therapy (TBMT) versus Clinic-Based McKenzie Therapy (CBMT)	A mobile app incorporating McKenzie extension protocol and back care education.	Healthcare	08 weeks	NA

Abbreviations: LBP, Lower Back Pain; NA, Not Applicable; NR, Not Reported; RCT, Randomized Controlled Trial.

Table 3 Cost Breakdown in Health Economic Studies on Telerehabilitation Strategies for Chronic Spinal Pain

Type of cost	Park et al, 2023[23]	Lewkowicz et al, 2022[22]	Fatoye et al, 2022[20]	Han et al, 2021[24]	Fatoye et al, 2019[21]	Proportion of Studies (%)
Intervention	+	+	+		+	80
Outpatient services		+	+		+	60
Diagnostic/ Lab services		+				20
Medication		+				20
Transportation			+	+	+	60
Productivity losses		+				20

Notes: +, Indicates the inclusion of the corresponding cost category in the study.

RAND 12-Item Health Survey (VR-12),[22] and SF-12.[23] In addition to QALY, outcomes related to pain and functional disability were also considered. The pain scales utilised were the Visual Analogue Scale (VAS)[24] and Numeric Pain Rating Scale (NPRS).[23] Lastly, functional disability outcomes were assessed using the Oswestry Disability Index (ODI) in two studies.[20,21]

Interventional Characteristics of Included Studies

The selected studies analysed a variety of standalone telerehabilitation strategies aimed at managing chronic spinal pain. All of these studies concluded the cost-effectiveness of these telerehabilitation interventions. These interventions can be broadly categorised into Mobile Application-Based Telerehabilitation and Virtual Video Games for Telerehabilitation. The interventional characteristics of included studies is presented in Table 4.

Telerehabilitation Interventions Based on Mobile Applications

Four out of the five studies implemented telerehabilitation interventions based on different mobile applications. The studies compared these interventions against conventional face-to-face interventions in three cases, while one study did not include a comparison group.[24] These interventions were aimed to provide remote support and rehabilitation coaching for individuals who were experiencing chronic spinal pain. Through the use of mobile technology, the interventions provided customised therapeutic activities, educational content, and monitoring capabilities, successfully bridging geographical gaps and improving access to specialised care. A notable feature that was common to these interventions was the incorporation of a patient feedback mechanism to allow for necessary therapy adjustments, thereby emphasising personalised care.

The first study of Park et al compared Digital Application Physical Therapy (DPT) using the DrAI application with conventional physical therapy in South Korea from a healthcare perspective. Both interventions were administered for 30 minutes per session, thrice weekly, across a span of four weeks. DrAI application was distinguished by its comprehensive data collection process, where patients entered detailed demographic and clinical information. The DrAI app then offered a preliminary McKenzie Method Diagnosis (MDT) and prescribed customised self-directed exercises presented in video format. These therapeutic exercises were dynamically adjusted based on patient feedback regarding pain and movement, demonstrating a significant level of customization.[23]

Similarly, in Nigeria, Fatoye et al conducted a study that explored the efficacy of Telerehabilitation-Based McKenzie Therapy (TBMT) compared to Clinic-Based McKenzie Therapy (CBMT), establishing TBMT's cost-effectiveness from a healthcare perspective. The interventions were conducted three times a week for a duration of eight weeks. TBMT intervention includes a mobile app that merged the McKenzie extension protocol with back care education. It presented a structured yet flexible series of exercises and educational content aimed at fostering self-management and compliance.[21]

Third study of Lewkowicz et al introduced the Kaia App, which differed from the previous interventions by employing a multi-dimensional approach that included back pain-specific education, physiotherapy exercises, and

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Table 4 Interventional Characteristics in the Included Health Economic Studies on Telerehabilitation Strategies for Chronic Spinal Pain

Study	Experimental			Control			ICER/ ICUR	WTP Threshold	Conclusion
	Type	Net Cost	Net Outcome	Type	Net Cost	Net Outcome			
Park et al, 2023[23]	Digital Application Physical Therapy (DPT)	$9.2	3.27 on NPRS; 120.45% improvement on FMS; 0.09 QALY	Conventional Physical Therapy (CPT)	$126.8	4.11 on NPRS; 89.40% improvement on FMS; 0.089 QALY	DPT dominant	$51,132.7 to $102,265.3/ QALY	DPT cost-effective
Lewkowicz et al, 2022[22]	Digital therapeutic care app	$3023.5	0.697 QALY	Treatment as usual	$2962.7	0.689 QALY	$8135/ QALY	$14,828.5 to $29,657/ QALY	Digital therapeutic care app cost-effective
Fatoye et al, 2022[20]	Back Extension-Virtual Reality Game (BE-VRG)	$114.2	3.54 on ODI and 0.087 QALY	Clinic-based McKenzie Therapy (CBMT)	$120.6	6.75 on ODI and QALY 0.084	BE-VRG dominant		BE-VRG cost-effective
Han et al, 2021[24]	Remote follow-ups and programming for SCS devices	$501	Pain relief rates on VAS were more than 50%						Implementation of remote follow-ups and programming for SCS devices is economical
Fatoye et al, 2019[21]	Telerehabilitation-Based McKenzie Therapy (TBMT)	$74.1	15.71 on ODI; 0.085 QALY	CBMT	$127.7	14.5 on ODI; 0.084 QALY	TBMT dominant		TBMT cost-effective

Notes: All costs originally denoted in their respective currencies and price year have been converted to US dollars (USD) for the year 2024 utilizing the cost converter tool of Campbell and Cochrane Economics Methods Group Evidence for Policy and Practice Information and Coordinating Centre. Comprehensive information regarding the initial costs and their conversion to USD for the year 2024 is presented in supplementary data 2. Variations in rounding methods applied to reported net costs and outcomes could lead to potential irreproducibility in ICER/ICUR values.

Abbreviations: ICER, Incremental Cost-Effectiveness Ratio; ICUR, Incremental Cost Utility Ratio; NPRS, Numeric Pain Rating Scale; ODI Oswestry Disability Index; PCS, Physical Component Score; WTP, Willingness to Pay.

mindfulness practices. Participants were encouraged to utilize the app at least four times a week during the three-month study duration. The application's content was adjusted dynamically based on user feedback, ensuring that the exercises and mindfulness practices were appropriately matched to the patient's current condition. The intervention was deemed cost-effective within Germany's economic framework from a societal perspective.[22]

Finally, the PINS-App was created by Han et al to help with remote programming and symptom management, connecting patients directly with physicians. The app had a significant difference from the previous studies in its focus and technological application, specifically focusing on patients who underwent Spinal Cord Stimulation (SCS) therapy. The app enabled instant adjustments to stimulation settings and offers a comprehensive care coordination platform, including access to medical history and daily outcome reporting.[24]

Virtual Video Games for Telerehabilitation

A single study was conducted in Nigeria that explored the use of Back Extension-Virtual Reality Game (BE-VRG) for telerehabilitation, concluding it to be cost-effective compared to CBMT from a healthcare perspective. The interventions took place thrice weekly, spanning a total of eight weeks.

BE-VRG is an interactive video game that featured a three-dimensional graphic environment on a computer or television screen. Tasks within BE-VRG were selected and designed to mirror therapeutic activities similar to the McKenzie "extension in standing" protocol, while also ensuring their relevance for the patient's rehabilitation. BE-VRG aimed to provide progressively challenging tasks to keep patient (player) engagement and motivation over time. During the gameplay, the screen displayed visual and textual feedback on the patients' performance and outcomes.[20]

Discussion

This systematic review evaluated health economic studies about telerehabilitation strategies for treating chronic spinal pain. Out of the five studies analysed, four demonstrated that telerehabilitation interventions were economically efficient than treatment as usual and conventional physical therapy from a social and healthcare perspective. The sixth study, which did not have a comparator group and solely concentrated on treating chronic spinal pain with SCS, also showed that using remote follow-ups and programming for SCS devices is cost-effective.[24]

While there are systematic reviews available to support the cost effectiveness of telerehabilitation, but these are primarily focused on cardiovascular disorders. For instance, Baffert et al conducted a systematic review of 11 economic evaluations, with six focusing on cardiovascular issues. In their review, over 50% of the studies did not demonstrate cost-effectiveness based on a willingness-to-pay criterion. However, five studies did indicate the cost efficacy of telerehabilitation.[25] Similarly, Baigi et al conducted a systematic review by using 11 studies, five of which specifically examined cardiovascular disorders. Telerehabilitation interventions were determined to be more cost-effective than conventional rehabilitation interventions in 64% of the studies.[26]

In the review, studies examined several telerehabilitation strategies for chronic spinal pain, with a predominant focus on TBMT in three studies.[20,21,23] The McKenzie technique focuses on promoting exercises that cause disc centralization and avoiding movements that lead to disc peripheralization.[27] Prior systematic reviews and meta-analysis have recognised the McKenzie method as an effective way for treating lower back pain.[28,29] Similarly, studies have also evaluated the clinical effectiveness of TBMT in particular. Mbada et al conducted a study comparing the efficacy of CBMT and TBMT in treating chronic low-back pain three times a week for eight weeks. The mobile-app platform for the McKenzie extension protocol was found to yield comparable clinical outcomes to traditional CBMT, serving as a beneficial adjunctive resource for managing low-back pain in patients.[30] In one other trial, 74 participants with non-specific chronic low back pain were randomly assigned to either the e-Health programme group, which received video instructions on McKenzie exercises, or the home rehabilitation programme group, which received printed information. The study indicates that patients who followed an unsupervised home intervention using a personalised video exercise programme showed greater improvement after treatment compared to those who used the same programme with printed instructions.[31] It can be concluded that TBMT may be deemed clinically and economically beneficial when compared to unsupervised home-based therapy or used as a supplement to CBMT. However, further research is required to draw a robust conclusion regarding the clinical and cost effectiveness of TBMT compared to CBMT.

Majority of our studies (n = 3) concentrated primarily on telerehabilitation interventions that employed physiotherapy. Nonetheless, the research conducted by Lewkowicz et al adopted a comprehensive telerehabilitation methodology incorporating three therapeutic dimensions: educational content on back pain, physiotherapy exercises, and mindfulness along with relaxation practices. Their findings underscored the clinical advantages and cost-effectiveness of this multi-faceted telerehabilitation intervention in comparison to conventional, in-person physical therapy.[22] However, there is a necessity for further research aimed at evaluating this multifaceted telerehabilitation approach against conventional face-to-face therapy and telerehabilitation that focuses on a singular therapeutic module.

According to the findings of this systematic review, decision makers should acknowledge the potential of telerehabilitation therapies as both clinical and economic efficient intervention for treating and managing chronic spinal pain. These can be particularly advantageous for individuals who struggle to access or afford traditional face-to-face therapy. Similarly, these interventions may also be a cost-effective option when compared to unsupervised home-based therapy or when used in conjunction with conventional rehabilitation. In addition, three of the five studies have used mobile applications as a medium of delivery for telerehabilitation, with the exception of two studies. The usage of smartphone has exceeded 3.3 billion users globally.[32] There is a rapid increase in the utilisation of mobile health applications in the healthcare sector. Therefore, in today times, mobile applications can be used as an effective platform for the delivery of telerehabilitation interventions.[33]

However, there are several drawbacks of telerehabilitation that should also be considered. The digital divide remains a significant barrier, particularly for underserved populations who may lack access to essential technologies such as smartphones and high-speed internet. Furthermore, concerns over data privacy, and the necessary modifications to healthcare infrastructure must also be acknowledged.[34] These considerations are vital for ensuring the successful integration and implementation of telerehabilitation across varied healthcare settings.

In addition to the drawbacks associated with telerehabilitation, several limitations of this review must also be acknowledged. Firstly, the studies were undertaken only in certain countries of Nigeria, the United Kingdom, South Korea, and Germany. Similarly, these studies specifically targeted patients with chronic spinal pain of lumbar origin only. Therefore, it is important to recognise that the findings may not be applicable to nations with different economic circumstances due to the differences in global economic systems. Lastly, half of our investigations used interventions with a duration of 4 to 8 weeks only and it is uncertain whether similar results may be observed by examining these telerehabilitation strategies over an extended duration of time. Based on these limitations, there are certain areas that need to be addressed in future research endeavours. It is crucial to do comprehensive economic evaluations using bigger and more representative sample sizes over extended durations, specifically focusing on chronic spinal pain of non-lumbar origin. Moreover, it is essential to perform similar economic assessments in other countries, especially in poor and middle-income nations, to enhance the relevance of the results. Additional research is also required to evaluate the efficacy of a multimodal telerehabilitation approach in relation to telerehabilitation utilizing a single component.

Conclusion

The interventions of telerehabilitation may present the most economically efficient approach compared to treatment as usual or conventional physical therapy for individuals with chronic lumbar spine pain. Among several telerehabilitation strategies, TBMT was notably cost efficient in comparison to unsupervised home-based therapy or when utilised as a supplement to CBMT. However, to draw a robust conclusion, it is essential to conduct comprehensive economic assessments with larger sample size over a prolonged duration. Similarly, it is crucial to carry out economic evaluations in several countries to create generalizable samples. Additional research is also required to assess the effectiveness of multimodal telerehabilitation approach in comparison to telerehabilitation with a single component.

Data Sharing Statement

The data that supports the findings of this study are available in the supplementary material of this article.

Ethical Approval

Ethical approval is not required for this study as it involves retrieving and synthesizing data from already published studies.

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Disclosure

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