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Review

Effectiveness of Telerehabilitation in Physical Therapy: A Rapid Overview

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Abstract

Objective. The purpose of this article was to summarize the available evidence from systematic reviews on telerehabilitation in physical therapy.

Methods. We searched Medline/PubMed, EMBASE, and Cochrane Library databases. In addition, the records in PROSPERO and Epistemonikos and PEDro were consulted. Systematic reviews of different conditions, populations, and contexts—where the intervention to be evaluated is telerehabilitation by physical therapy—were included. The outcomes were clinical effectiveness depending on specific condition, functionality, quality of life, satisfaction, adherence, and safety. Data extraction and risk of bias assessment were carried out by a reviewer with non-independent verification by a second reviewer. The findings are reported qualitatively in the tables and figures.

Results. Fifty-three systematic reviews were included, of which 17 were assessed as having low risk of bias. Fifteen reviews were on cardiorespiratory rehabilitation, 14 on musculoskeletal conditions, and 13 on neurorehabilitation. The other 11 reviews addressed other types of conditions and rehabilitation. Thirteen reviews evaluated with low risk of bias showed results in

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favor of telerehabilitation versus in-person rehabilitation or no rehabilitation, while 17 reported no differences between the groups. Thirty-five reviews with unclear or high risk of bias showed mixed results.

Conclusions. Despite the contradictory results, telerehabilitation in physical therapy could be comparable with in-person rehabilitation or better than no rehabilitation for conditions such as osteoarthritis, low-back pain, hip and knee replacement, and multiple sclerosis and also in the context of cardiac and pulmonary rehabilitation. It is imperative to conduct better quality clinical trials and systematic reviews.

Impact. Providing the best available evidence on the effectiveness of telerehabilitation to professionals, mainly physical therapists, will impact the decision-making process and therefore yield better clinical outcomes for patients, both in these times of the COVID-19 pandemic and in the future. The identification of research gaps will also contribute to the generation of relevant and novel research questions.

Keywords: Digital Health, E-Health, Remote Physical Therapy, Telehealth, Telemedicine, Telerehabilitation

Introduction

Rehabilitation is necessary to improve people's ability to live, work, and learn as much as possible and to maximize their functionality and quality of life. The impact extends to the community, society, and the economy.[1,2] While rehabilitation is a comprehensive, multicomponent, and multidisciplinary intervention, the specific health condition and other determinants of the health system or resources available determine the minimum components required, which often include physical therapy.

Physical therapist interventions are required when movement and function are threatened to develop, maintain, and reestablish movement and functional capacity under the consideration that functional movement is fundamental to health and an optimal quality of life.[3]

Despite the knowledge of the benefits of rehabilitation and physical therapy, these services are under-used.[4] If to this is added, on the one hand, that services or patient resources are scarce,[5] and on the other that high demand leads to the saturation of services and the generation of waiting lists,[6] the limitation of access becomes a reality.

In this scenario, where rehabilitation is necessary but insufficiently implemented, alternative rehabilitation models have been created using new resources such as digital practice to improve coverage. Thus, telerehabilitation, considered a branch of telehealth, is set up as a system for the control or monitoring of remote rehabilitation using telecommunications technologies, the purpose of which is to increase accessibility and improve continuity of care in vulnerable, geographically remote populations with disabilities with the potential for saving time and resources in health care.[7,8]

In the context of infection by SARS-CoV-2 and the spread of the COVID-19 pandemic, health services have had to adapt and prioritize safe delivery of care, limiting outpatient care. Thus, in addition to finding a way to address patients affected by COVID-19, an innovative method had to be found to provide rehabilitation or physical therapy.[9,10] Although the main task is to contain the spread of the infection and treat patients affected by COVID-19, health systems cannot ignore other health problems that will inevitably require attention in the future. This crisis will undoubtedly impact the way health services work, and telerehabilitation could become a standard way of working since the previously identified barriers have had to be quickly overcome.[11,12]

There are several telerehabilitation models implemented globally.[13,14] There are also many studies that have examined its effectiveness. To date, so many telerehabilitation trials are available that many systematic reviews have summarized the scattered and contradictory findings.[15–23]

To provide support to rehabilitation professionals, mainly physical therapists, with the best evidence available, this study aims to summarize the available information from systematic reviews on telerehabilitation in physical therapy in terms of clinical effectiveness, functionality, and quality of life. Additionally, adherence, satisfaction, and safety outcomes are evaluated.

Methods

An overview was conducted in a rapid review format adhering to the PRISMA declaration for systematic reviews.[24] The protocol is registered in PROSPERO under number CRD42020185640, and the methodology has already been extensively described elsewhere.[25] Likewise, the critical methods aspects of the overview are described below.

Data Sources and Searches

A systematic search was carried out in electronic databases (Medline/PubMed, EMBASE, Cochrane Library) up to May 4, 2020. The search strategy is available in Supplementary Table 1. In addition, the records in PROSPERO and the filtered databases Epistemonikos and PEDro were consulted. No restriction on language or date was applied.

Study Selection

Systematic reviews about several conditions of interest (musculoskeletal, neurological, respiratory, cardiovascular, etc), populations (infants, children, adults, and the elderly), and contexts (primary, secondary, and tertiary or specialist attention) were considered eligible if they included an explicit systematic review methodology and the primary studies included were clinical trials. If a systematic review included studies with other designs, they were considered only if they contained disaggregated data from clinical trials.

Systematic review protocols and conference proceedings were excluded if the full text was not available.

The intervention must have been telerehabilitation by physical therapy, defined as the provision of rehabilitation with interventions in any area of physical therapy carried out remotely or outside a usual session by a therapist distant from the patient and using telecommunications technologies. A systematic review was included if it considered comprehensive telerehabilitation with at least 1 component of physical therapy or if it contained a physical therapy treatment only.

Physical therapy had to be therapeutic exercises, functional training, manual therapy, respiratory techniques and exercises, integumentary repair and protection techniques, electrotherapy and physical agents, or education as defined by the World Confederation for Physical Therapy.[3]

Reviews were excluded if they focused on physical activity without considering clinical outcomes (eg, blood pressure control) and on self-management of health conditions (eg, hypertension) where exercise and its effect on a clinical outcome were not included. Similarly, reviews were excluded that considered mobile applications and monitors (eg, pedometer) without involving the active action of a physical therapist. Finally, systematic reviews assessing virtual reality, without remote supervision by a therapist and not performed outside the health center, were also excluded.

Regarding comparisons, reviews were included if the telerehabilitation was compared with usual rehabilitation (in-person rehabilitation or center-based rehabilitation) or no rehabilitation (including usual care and waiting list).

Primary outcomes that had to be included in the reviews were clinical effectiveness for each condition (eg, decreasing low-back pain). Functionality was defined as the physical abilities that enable functional independence and enhance health-related quality of life (HRQL). Secondary outcomes were satisfaction with the care, adherence, and adverse effects.

The selection process was performed in the Rayyan software[26] by 2 investigators, first screening by title and abstract and then by reviewing full texts of the relevant records. The discrepancies were resolved by a third reviewer with more than 10 years of experience.

Data Extraction and Quality Assessment

The relevant information from each eligible document was extracted through the REDCap platform (Research Electronic Data Capture software).[27] The risk of bias of the included reviews was assessed with the Risk of Bias in Systematic Reviews (ROBIS) tool.[28] ROBIS was applied in 3 consecutive phases. First, the relevance of the review for the research question was assessed. Then, concerns with the review process were identified for 4 domains: study eligibility criteria, identification and selection of the studies, data collection and study appraisal, and synthesis and findings. Finally, a judgment of overall bias in the review was generated. Both the data extraction and the appraisal with ROBIS were performed by 1 investigator, and a non-independent verification was carried out by a second experienced investigator. Additionally, information related to the methodological quality or risk of bias of the primary studies contained in the reviews assessed as having a low risk of bias was extracted to consider this aspect in formulating the conclusions of the overview.

Data Synthesis and Analysis

A qualitative report of the characteristics and effectiveness findings is summarized in the figures and tables by clinical area of rehabilitation or physical therapist interventions. In the design and presentation of the tables and figures, the risk of bias of the included reviews is considered.

Role of the Funding Source

The funder played no role in the design, conduct, or reporting of this study.

Results

Study Selection

In the initial search of electronic databases, 3298 potential studies were identified. Additionally, 8 records were identified through searches of filtered databases. After elimination of duplicates, 3089 unique entries were obtained, which were screened by title and abstract, excluding 2830 studies because they did not meet at least 1 of the eligibility criteria of our overview. Of the 259 studies reviewed in full text, 206 were excluded, with 53 systematic reviews finally being included. Supplementary Figure 1 shows the PRISMA flowchart and the reasons for excluding studies at the full-text stage are presented in Supplementary Table 2.

Characteristics of Included Studies

Twenty-one reviews were performed in Europe, 12 in Oceania, 11 in North America, 7 in Asia, 1 in Africa, and 1 in South America. All 53 reviews included 754 studies, of which 425 were included because they were clinical trials and considered outcomes of interest. Regarding synthesis, 26 were systematic reviews with qualitative synthesis only and 27 included a meta-analysis.

The most common areas of physical therapy included were: cardiorespiratory rehabilitation (15 studies), musculoskeletal rehabilitation (14 studies), and neurorehabilitation (13 studies). The other 11 reviews addressed other or mixed types of conditions and rehabilitation.

Most of the studies included adults (n = 41), older people (n = 2), the infant population (n = 2), and others (n = 8). In addition to physical therapists, other professionals participated, including psychologists (24 reviews), nurses (15 reviews), physicians (13 reviews), occupational therapists (8 reviews), and speech therapists (4 reviews).

Characteristics of Interventions

The most common interventions were therapeutic exercises (48), functional training (27), and education (25). Three reviews included only synchronous interventions, and 1 included solely asynchronous interventions. Most of the reviews (49) included mixed interventions. The majority of the platforms implemented to deliver the rehabilitation were webpages in 43 reviews, phone calls in 37 reviews, teleconference software in 31 reviews, and messaging services in 14 reviews. Virtual reality, understood as its use with remote assistance by the therapist, was also used and reported in 9 reviews.

Comparisons

The comparisons evaluated were telerehabilitation versus in-person rehabilitation (or usual rehabilitation) in 24 reviews, telerehabilitation versus no rehabilitation (or usual care or waiting list) in 27 reviews, and mixed comparisons (eg, telerehabilitation plus in-person intervention versus in-person intervention alone) in 22 reviews.

Outcomes

The most-reported outcomes were clinical effectiveness in 48 reviews, functionality in 35 reviews, quality of life in 32 reviews, user satisfaction and adherence in 15 reviews each, and adverse events in 13 reviews.

Characteristics by Area

Specific characteristics of included reviews are presented in Table 1 for musculoskeletal, neurological, cardiopulmonary, and other health conditions.

Musculoskeletal Rehabilitation

Musculoskeletal rehabilitation was reported in 14 systematic reviews,[16,22,29–40] including 6 reviews that reported meta-analyses. The majority of conditions included were low-back pain, hip arthroplasty, total knee arthroplasty, and osteoarthritis, and the most common outcomes reported were pain intensity as an expression of clinical effectiveness, functionality—mostly measured by the WOMAC tool—and HRQL.

Neurorehabilitation

Neurorehabilitation was reported in 13 systematic reviews,[17,20,41–51] including 7 reviews that reported meta-analyses. The majority of conditions included were stroke, multiple sclerosis, and physical impairment in children. The most common outcomes reported were motor function, mobility, balance, activities of daily living, and HRQL.

Cardiorespiratory Rehabilitation

The cardiorespiratory rehabilitation was reported in 15 systematic reviews,[15,19,21,52–63] including 9 reviews that reported meta-analyses. The majority of conditions included were coronary artery disease, heart failure, and chronic obstructive pulmonary disease (COPD). The most common outcomes reported were related to clinical effectiveness as exercise capacity and HRQL.

Others Health Conditions

Other types of rehabilitation were reported in 11 reviews,[8,18,64–72] of which 5 included meta-analyses. The majority of conditions covered were associated with metabolic disorders (such as obesity or diabetes) and cancer. The most common outcome reported was physical or exercise capacity.

Risk of Bias

Of the 53 reviews included, 35 were relevant for the research question while the other 18 were partially relevant. Regarding the overall review process, 17 (32%) reviews were assessed as having a low risk of bias, 24 (45%) as having a high risk of bias, and 12 (23%) as having an unclear risk of bias in the evaluation with the ROBIS tool.

By clinical area, there were 7 of 14 (50%) musculoskeletal,[16,22,36–40] 4 of 13 (31%) neurological,[17,20,50,51] and 7 of 15 (46%) cardiovascular[15,19,21,60–63] reviews considered to be at high risk of bias, while 5 of 11 (46%) also had a high risk of bias assessment in reviews covering other health conditions.[68–72] On the other hand, musculoskeletal, neurological, cardiovascular, and other health conditions were evaluated as being at low risk of bias in 7 (50%),[29–35] 3 (24%),[41–43] 4 (27%),[52–55] and 3 (27%)[18,64,65] reviews, respectively.

The domain with the greatest concerns was synthesis and findings, with 22 (42%) reviews assessing it as being at high risk of bias, and 12 (23%) reviews as being at an unclear risk of bias. Meanwhile, the domain with the best rating was that of data collection and study appraisal, with 37 (70%) reviews being evaluated as at low risk of bias.

The ratings for each of the 4 domains in the ROBIS tool and the overall evaluation for the included reviews by clinical area are presented in Table 2. Complementarily, Supplementary Table 1 shows the reported assessment of the methodological quality or risk of bias of the primary studies included, specifically in the systematic reviews evaluated as having a low risk of bias.

Effect of Interventions

Supplementary Tables 4–7 show specific findings for several comparisons in each review included with the specification of outcomes and their measurements, source of results, conclusion of the review authors, and risk of bias overall evaluation.

Musculoskeletal

A summary of results is presented in Figure 1. Only 1 low risk of bias review compared telerehabilitation with in-person rehabilitation. This review reported the effectiveness of telerehabilitation for clinical (pain intensity) and functionality outcomes and no difference between groups for HRQL in unspecified musculoskeletal conditions.[29]

Seven low risk of bias reviews compared telerehabilitation with a control group without rehabilitation. Of these, 6, 4, and 1 reviews reported no difference between groups for clinical effectiveness evaluated as pain intensity,[29–31,33–35] functionality,[29,30,34,35] and HRQL,[34] respectively. On the other hand, 2 reviews showed differences between groups in all primary studies included in favor of telerehabilitation for functionality in patients with osteoarthritis of knee[31] and with low-back pain.[32] Another 5 reviews reported better results of telerehabilitation for HRQL, specifically in low-back pain,[30,32] symptomatic osteoarthritis of the knee,[31] total knee,[33,35] and hip arthroplasty.[35] Additionally, 1 review reported clinical effectiveness for pain in 1 of 3 primary studies and for pain-related disability in non-specific low-back pain.[32] Only 1 review considered the other outcomes, reporting no differences for satisfaction and adherence but more adverse effects for the intervention group.[35]

Another 6, 3, and 3 reviews evaluated as having a high risk of bias, reported no differences between telerehabilitation and in-person rehabilitation groups for clinical effectiveness,[22,36–40] functionality,[36,37,39] and HRQL,[22,37,38] respectively. For the same comparison, 3 reviews reported better functionality in the telerehabilitation group,[16,38,40] and 1 review showed same result in some primary studies included.[22] On the other hand, for the telerehabilitation versus no-rehabilitation comparison, 1 high-risk-of-bias review showed better health status with telerehabilitation,[36] and another high-risk-of-bias review reported better effectiveness for pain and functionality in some primary studies included.[16]

Neurorehabilitation

A summary of results is presented in Figure 2. Three low-risk-of-bias reviews compared telerehabilitation with in-person rehabilitation. One, 2, and 1 reviews reported no difference between groups for clinical effectiveness evaluated as balance,[42] functionality,[42,51] and HRQL,[42] respectively. Two reviews showed better results in telerehabilitation groups for balance[41] and physical activity[51] in patients with multiple sclerosis. Two reviews considered other outcomes showing no adverse effects[41] and no differences for satisfaction[42] in the telerehabilitation group.

Table 1. Characteristic of Included Reviews[a]

Author/Year	Search Date	Specific Population/Ages	No. of Studies Included in Original Review	No. of Studies Included in Overview[b]	Physical Therapist Intervention	Characteristics of Telerehabilitation	Type of Synthesis
Telerehabilitation in musculoskeletal conditions							
Cottrell et al, 2017[29]	November 2015	Any diagnosed primary musculoskeletal condition/>19 y	13	7	Therapeutic exercises, functional training and education	Mixed (synchronous and asynchronous) phone, internet	Qualitative and quantitative
Dario et al, 2017[30]	August 2015	Non-specific low-back pain/>19 y	11	8	Therapeutic exercises and education	Mixed (synchronous and asynchronous) phone, internet	Qualitative and quantitative
Heapy et al, 2015[36]	September 2014	Chronic, noncancer, nonheadache pain/>19 y	44	4	Therapeutic exercises and functional training	Mixed (synchronous and asynchronous) phone, internet	Qualitative
Jansson et al, 2020[22]	February 2020	Total hip arthroplasty and total knee arthroplasty/>19 y	9	7	Therapeutic exercises, functional training, and education	Mixed (synchronous and asynchronous) phone, internet, devices	Qualitative
Jiang et al, 2018[40]	May 2016	Total knee arthroplasty/>65 y	4	4	Therapeutic exercises	Synchronous internet, devices	Qualitative and quantitative
Joice et al, 2017[37]	1996 to May 2016	Total knee arthroplasty/19 y or more	17	3	Therapeutic exercises	Mixed (synchronous and asynchronous) phone, internet	Qualitative
Grona et al, 2018[38]	December 2016	Chronic musculoskeletal disorders (>3 mo duration)/>19 y	17	2	Therapeutic exercises and education	Synchronous internet	Qualitative
Schäfer et al, 2018[31]	July 2017	Symptomatic unilateral or bilateral Osteoarthritis of knee/all ages	7	6	Therapeutic exercises	Synchronous phone, devices	Quantitative
Nicholl et al, 2017[32]	2000 to March 2016	Non-specific low-back pain/19 y or more	9	3	Therapeutic exercises, manual therapy, physical therapy, and education	Mixed (synchronous and asynchronous) phone, internet	Qualitative
Pastora-Bernal et al, 2017[39]	2000 to October 2016	Surgical procedures as result of orthopedic condition/>19 y	15	9	Therapeutic exercises	Mixed (synchronous and asynchronous) phone, internet	Qualitative
Pietrzak et al, 2013[16]	November 2011	Osteoarthritis/>19 y	5	3	Therapeutic exercises and use of physical agents	Mixed (synchronous and asynchronous), internet	Qualitative

(*Continued*)

Table 1. Continued

Author/Year	Search Date	Specific Population/Ages	No. of Studies Included in Original Review	No. of Studies Included in Overview[b]	Physical Therapist Intervention	Characteristics of Telerehabilitation	Type of Synthesis
Shukla et al, 2017[33]	2014	Total knee arthroplasty/>65 y	6	2	Therapeutic exercises and functional training	Mixed (synchronous and asynchronous) phone, internet	Qualitative and quantitative
Srikesavan et al, 2019[34]	January 2016	Clinical diagnosis of rheumatoid arthritis/>19 y	4	3	Therapeutic exercises, functional training, manual therapy, and education	Mixed (synchronous and asynchronous) phone, internet, devices	Qualitative
Wang et al, 2019[35]	November 2018	Total hip arthroplasty and total knee arthroplasty/>19 y	21	14	Therapeutic exercises and functional training	Mixed (synchronous and asynchronous) phone, internet, devices	Qualitative and quantitative
Telerehabilitation in neurological conditions							
Appleby et al, 2019[44]	November 2019	Stroke survivors/> 18 y	13	10	Neurorehabilitation	Mixed (synchronous and asynchronous) Videoconferencing, virtual reality, messaging, phone, devices	Qualitative
Camden et al, 2019[47]	March 2018	Children with disabilities/>12 y	23	4	Neurorehabilitation	Mixed (synchronous and asynchronous) webpage, videoconferencing, virtual reality, phone, devices	Qualitative
Chen et al, 2015[45]	March 2015	Stroke survivors/> 18 y	11	8	Neurorehabilitation	Mixed (synchronous and asynchronous) phone, videoconferencing, robot-assisted rehabilitation, virtual reality	Quantitative
Di Tella et al, 2020[50]	December 2018	Multiple sclerosis/all ages	10	5	Integrated rehabilitation approach (ITA)	Mixed (synchronous and asynchronous) phone, email, web platform	Quantitative
Johansson et al, 2011[17]	November 2009	Stroke survivors/> 18 y	9	2	Neurorehabilitation	Mixed (synchronous and asynchronous) webpage, videoconferencing, devices	Qualitative
Khan et al, 2015[41]	July 2014	Multiple sclerosis/> 18 y	9	7	Neurorehabilitation	Mixed (synchronous and asynchronous). Videoconferencing, virtual reality	Qualitative
Laver et al, 2020[42]	June 2019	Stroke survivors/all ages	22	9	Neurorehabilitation	Mixed (synchronous and asynchronous) webpage, videoconferencing, virtual reality, devices, phone	Quantitative

(*Continued*)

Table 1. Continued

Author/Year	Search Date	Specific Population/Ages	No. of Studies Included in Original Review	No. of Studies Included in Overview[b]	Physical Therapist Intervention	Characteristics of Telerehabilitation	Type of Synthesis
Rintala et al, 2018[43]	December 2015	Multiple sclerosis/> 18 y	11	7	Integral rehabilitation	Mixed (synchronous and asynchronous) devices, virtual reality, web platform, phone	Quantitative
Rintala et al, 2019[51]	May 2018	Stroke survivors/all ages	13	7	Neurorehabilitation	Mixed (synchronous and asynchronous) devices, virtual reality, web platform, phone	Qualitative and quantitative
Sarfo et al, 2018[20]	June 2017	Stroke survivors/not reported	22	18	Neurorehabilitation	Mixed (synchronous and asynchronous) phone, devices, webpage, educational platform, virtual reality	Qualitative
Schröder et al, 2019[46]	January 2018	Stroke survivor/> 18 y	7	4	Motor training, balance training	Mixed (synchronous and asynchronous) devices, virtual reality	Qualitative
Tchero et al, 2018[48]	January 2018	Stroke survivors/> 18 y	15	7	Integral rehabilitation	Mixed (synchronous and asynchronous) web platform, videoconferencing, devices	Qualitative and quantitative
Xiaoyan et al, 2019[49]	January 2019	Stroke survivors/> 18 y	11	7	Therapeutic exercise	Mixed (synchronous and asynchronous) devices, virtual reality, videoconferencing	Qualitative and quantitative
Telerehabilitation in cardiopulmonary conditions							
Almojaibel et al, 2016[19]	September 2014	COPD/>19 y	7	2	Pulmonary rehabilitation (aerobic and resistance exercise, incentive of physical activity)	Mixed (synchronous and asynchronous) internet, devices	Qualitative
Brørs et al, 2019[56]	January 2003 to March 2018	Coronary artery disease/>19 y	24	9	Physical activity and exercise management through exercise plans, supervision, and counselling	Mixed (synchronous and asynchronous) internet, devices, other	Qualitative
Chan et al, 2016[62]	July 2015	COPD and with cardiovascular disease/>19 y	9	8	Cardiac and pulmonary rehabilitation	Mixed (synchronous and asynchronous) phone, internet, devices	Qualitative and quantitative
Cristo et al, 2018[21]	Not reported	Cardiovascular diseases/>19 y	7	3	Cardiac rehabilitation (videogames, incentive of walking, Nordic training, cycle-ergometer)	Mixed (synchronous and asynchronous) devices	Qualitative
Frederix et al, 2015[63]	Not reported	Cardiac patients/not reported	37	13	Cardiac rehabilitation and telemonitoring	Synchronism not reported phone, internet, devices	Qualitative and quantitative

(*Continued*)

Table 1. Continued

Author/Year	Search Date	Specific Population/Ages	No. of Studies Included in Original Review	No. of Studies Included in Overview[b]	Physical Therapist Intervention	Characteristics of Telerehabilitation	Type of Synthesis
Hamilton et al, 2018[60]	August 2016	Acute coronary syndrome and at least 1 coronary risk factor/>19 y	9	2	Cardiac rehabilitation	Mixed (synchronous and asynchronous) phone	Qualitative
Huang et al, 2015[52]	April 2014	Myocardial infarction, angina, or underwent vascularization/>19 y	9	9	Cardiac rehabilitation	Mixed (synchronous and asynchronous) phone, other	Qualitative and quantitative
Hwang et al, 2015[61]	August 2013	Cardiopulmonary diseases/>18 y	11	11	Integral rehabilitation	Mixed (synchronous and asynchronous) phone	Qualitative
Jin et al, 2019[57]	April 2018	Coronary heart disease with at least 3 mo follow-up/>19 y	29	26	Cardiac rehabilitation	Mixed (synchronous and asynchronous) phone, internet, devices, other	Qualitative and quantitative
Lundell et al, 2015[53]	August 2013	COPD according to GOLD, ERS, ATS, or BTS/>40 y	9	7	Cardiovascular exercises, pedometer, pursed lips, relaxation exercises	Mixed (synchronous and asynchronous) phone, internet, devices	Qualitative and quantitative
McCabe et al, 2017[58]	November 2016	COPD according to GOLD 2016 and at any stage of illness/>19 y	3	3	Incentive of physical activity (pedometer, web incentive, and digital coaching)	Mixed (synchronous and asynchronous) internet	Quantitative
Munro et al, 2013[15]	May 2013	Cardiac patients/>19 y	9	7	Cardiac rehabilitation	Mixed (synchronous and asynchronous) phone, internet	Qualitative
Neubeck et al, 2009[59]	December 2008	Coronary heart disease with at least 3 mo follow-up/>19 y	11	11	Cardiac rehabilitation	Mixed (synchronous and asynchronous) phone, internet	Qualitative and quantitative
Rawstorn et al, 2016[54]	May 2015	Coronary heart disease/>19 y	11	8	Cardiac rehabilitation	Asynchronous phone	Qualitative and quantitative
Su et al, 2020[55]	April 2019	Coronary heart disease/>19 y	14	7	Cardiac rehabilitation	Mixed (synchronous and asynchronous) website, mobile application, email, text message, phone	Qualitative and quantitative
Telerehabilitation in other health conditions or mixed reviews							
Adamse et al, 2018[66]	2015	Chronic pain in adults/>19 y	16	9	Exercise, physical activity, or training prescription	Mixed (synchronous and asynchronous) phone, internet	Qualitative and quantitative
Agostini et al, 2015[68]	January 2014	Different conditions with impaired motor function/all ages	12	12	Motor training	Mixed (synchronous and asynchronous) phone, internet, devices	Quantitative

(*Continued*)

Table 1. Continued

Author/Year	Search Date	Specific Population/Ages	No. of Studies Included in Original Review	No. of Studies Included in Overview[b]	Physical Therapist Intervention	Characteristics of Telerehabilitation	Type of Synthesis
An et al, 2009[69]	April 2009	Children and adolescents with overweight/6–18 y	8	8	Physical activity incentive within comprehensive rehabilitation	Mixed (synchronous and asynchronous) internet	Qualitative
Connelly et al, 2013[70]	March 2013	Type 2 diabetes in adults/>19 y	15	5	Physical activity, training or exercise prescription, education	Mixed (synchronous and asynchronous) internet	Qualitative
van Egmond et al, 2018[72]	November 2016	Cardiac, orthopedic surgery, and oncological surgery/>19 y	23	23	Physical exercise training within comprehensive rehabilitation	Mixed (synchronous and asynchronous) phone calls, internet platform, videoconference and devices	Qualitative and quantitative
Geraedts et al, 2013[67]	July 2012	Older adults/>19 y	32	25	Structured physical activity or exercise	Mixed (synchronous and asynchronous) phone, internet platform and devices	Qualitative
Huang et al, 2019[65]	August 2014	Adults/>19 y	25	25	Exercise or physical activity incentive, education	Mixed (synchronous and asynchronous) internet-based system, phone, text messaging, videoconferencing	Quantitative
Kairy et al, 2009[8]	February 2007	Cardiac, respiratory, musculoskeletal, or neurological conditions/>19 y	28	4	Therapeutic exercise, functional training within comprehensive rehabilitation	Mixed (synchronous and asynchronous) internet, mobile phone, devices and software	Qualitative
Kopp et al, 2017[71]	November 2015	Cancer survivors/all ages	6	3	Cardiorespiratory and physical training, education	Mixed (synchronous and asynchronous) phone, devices, apps, webpage, virtual reality, email, text messaging, video games	Qualitative
Seiler et al, 2017[64]	November 2016	Cancer survivors with fatigue/>19 y	15	2	Resistance and aerobic exercise training	Mixed (synchronous and asynchronous) online interventions or smartphone apps	Qualitative
Wieland et al, 2012[18]	May 2011	Overweight or obesity/>18 y	18	13	Physical activity and exercise education within a weight maintenance programs	Mixed (synchronous and asynchronous) computer-based intervention requiring user to interact directly with computer	Qualitative and quantitative

[a]ATS = American Thoracic Society; BTS = British Thoracic Society; COPD = Chronic Obstructive Pulmonary Disease; ERS = European Respiratory Society; GOLD = Global Initiative for Chronic Obstructive Lung Disease. [b]Clinical trial including physical therapy intervention and comparison group with in-person intervention, no intervention (usual care or wait list), or mixed intervention.

Table 2. Risk of Bias of Systematic Reviews (ROBIS) Included by Clinical Area[a]

Systematic Review	Phase 1	Phase 2				Phase 3
	Corresponding Question	Study Eligibility Criteria	Identification And Selection of the Studies	Data Collection and Study Appraisal	Synthesis and Findings	Overall Evaluation
Telerehabilitation in Musculoskeletal Conditions						
Cottrell et al, 2017[29]	Partially	☺	☺	☺	☺	☺
Dario et al, 2017[30]	Partially	☺	☺	☺	☺	☺
Heapy et al, 2015[36]	Partially	¿?	☹	☹	☹	☹
Jansson et al, 2020[22]	Yes	☹	¿?	☺	☹	☹
Jiang et al, 2018[40]	Yes	☺	¿?	☹	¿?	☹
Joice et al, 2017[37]	Partially	¿?	☹	☹	☹	☹
Grona et al, 2018[38]	Yes	¿?	☹	☺	☹	☹
Schäfer et al, 2018[31]	Yes	☺	☺	☺	☺	☺
Nicholl et al, 2017[32]	Partially	☺	☺	☺	☺	☺
Pastora-Bernal et al, 2017[39]	Yes	☺	☺	☹	☹	☹
Pietrzak et al, 2013[16]	Yes	¿?	¿?	☹	☹	☹
Shukla et al, 2017[33]	Partially	☺	☺	☺	☺	☺
Srikesavan et al, 2019[34]	Yes	☺	☺	☺	☺	☺
Wang et al, 2019[35]	Yes	☺	☺	☺	☺	☺
Telerehabilitation in Neurological Conditions						
Appleby et al, 2019[44]	Yes	☺	¿?	☺	¿?	¿?
Camden et al, 2019[47]	Yes	☺	☺	☺	¿?	¿?
Chen et al, 2015[45]	Yes	☺	☺	☺	¿?	¿?
Di Tella et al, 2020[50]	Yes	¿?	☺	¿?	☹	☹
Johansson et al, 2011[17]	Yes	¿?	☹	☹	☹	☹
Khan et al, 2015[41]	Partially	☺	☺	☺	☺	☺
Laver et al, 2020[42]	Yes	☺	☺	☺	☺	☺
Rintala et al, 2018[43]	Yes	☺	☺	☺	☺	☺
Rintala et al, 2019[51]	Yes	☺	☺	☺	☹	☹
Sarfo et al, 2018[20]	Yes	☺	☹	☹	☹	☹
Schröder et al, 2019[46]	Yes	☹	¿?	☺	☹	☹
Tchero et al, 2018[48]	Yes	☺	☺	¿?	¿?	¿?
Xiaoyan et al, 2019[49]	Yes	☺	☺	☺	¿?	¿?

(*Continued*)

Two low-risk-of-bias reviews compared telerehabilitation with a control group without rehabilitation. Of these, 1, 2, and 1 reviews reported no difference between groups for clinical effectiveness evaluated as balance,[42] functionality,[41,42] and HRQL,[42] respectively. One review about multiple sclerosis reported clinical effectiveness for disability in 2 of 3 primary studies and for HRQL in 2 of 4 primary studies.[41] Two reviews considered the other outcomes reporting no adverse effects[41,42] and no differences[42] or better satisfaction[41] in the telerehabilitation group.

Three, 2, and 1 reviews evaluated as having an unclear risk of bias reported no differences for clinical effectiveness,[44–46] functionality,[44,45] and HRQL,[44] respectively, between telerehabilitation and in-person rehabilitation groups. For the same

Table 2. Continued

Systematic Review	Phase 1	Phase 2				Phase 3
	Corresponding Question	Study eligibility criteria	Identification and selection of the studies	Data collection and study appraisal	Synthesis and findings.	Overall evaluation
Telerehabilitation in Cardiopulmonary Conditions						
Almojaibel et al, 2016[19]	Yes	☹	☹	☹	☹	☹
Brørs et al, 2019[56]	Partially	¿?	¿?	☺	☺	¿?
Chan et al, 2016[62]	Partially	¿?	☹	☹	☹	☹
Cristo et al, 2018[21]	Yes	☺	☺	☺	☹	☹
Frederix et al, 2015[63]	Yes	☹	¿?	☹	☹	☹
Hamilton et al, 2018[60]	Partially	☺	☺	☺	☹	☹
Huang et al, 2015[52]	Yes	☺	☺	☺	☺	☺
Hwang et al, 2015[61]	Yes	¿?	☺	☺	☹	☹
Jin et al, 2019[57]	Yes	☺	☺	¿?	¿?	¿?
Lundell et al, 2015[53]	Yes	☺	☺	☺	☺	☺
McCabe et al, 2017[58]	Yes	☺	☺	☺	¿?	¿?
Munro et al, 2013[15]	Partially	¿?	☹	☺	☹	☹
Neubeck et al, 2009[59]	Yes	☹	☺	☺	☺	¿?
Rawstorn et al, 2016[54]	Yes	☺	¿?	☺	☺	☺
Su et al, 2020[55]	Partially	☺	☺	☺	☺	☺
Telerehabilitation in Others Health Conditions or Mixed Reviews et al,						
Adamse et al, 2018[66]	Yes	☺	☺	☺	¿?	¿?
Agostini et al, 2015[68]	Partially	¿?	¿?	☺	☹	☹
An et al, 2009[69]	Yes	☺	¿?	☹	☹	☹
Connelly et al, 2013[70]	Partially	☹	☹	☹	☹	☹
Van Egmond et al, 2018[72]	Yes	☺	☺	☺	☹	☹
Geraedts et al, 2013[67]	Partially	☺	☺	☺	¿?	¿?
Huang et al, 2019[65]	Yes	¿?	☺	☺	☺	☺
Kairy et al, 2009[68]	Partially	☺	☺	☺	¿?	¿?
Kopp et al, 2017[71]	Partially	¿?	¿?	☹	¿?	☹
Seiler et al, 2017[64]	Yes	☺	☺	☺	☺	☺
Wieland et al, 2012[18]	Partially	☺	☺	☺	☺	☺

[a]☺ = Low Risk of Bias; ¿? = Unclear Risk of Bias; ☹ = High Risk of Bias

comparison, 1 review showed mixed results for HRQL in patients with stroke.[45] On the other hand, for the telerehabilitation versus no-rehabilitation comparison, 1 unclear-risk-of-bias review showed better motor function in children with disabilities in the telerehabilitation group and also reported better effectiveness for functionality in some of the primary studies included.[47]

Finally, of 4 high-risk-of-bias reviews, 1 review about multiple sclerosis reported better results for motor disability in the telerehabilitation group compared with the in-person group and no differences for functionality.[50] The other 3 reviews reported no differences between groups for clinical effectiveness in stroke survivors[17,20,51] in the same comparison. Additionally, 1 review at high risk of bias showed no differences

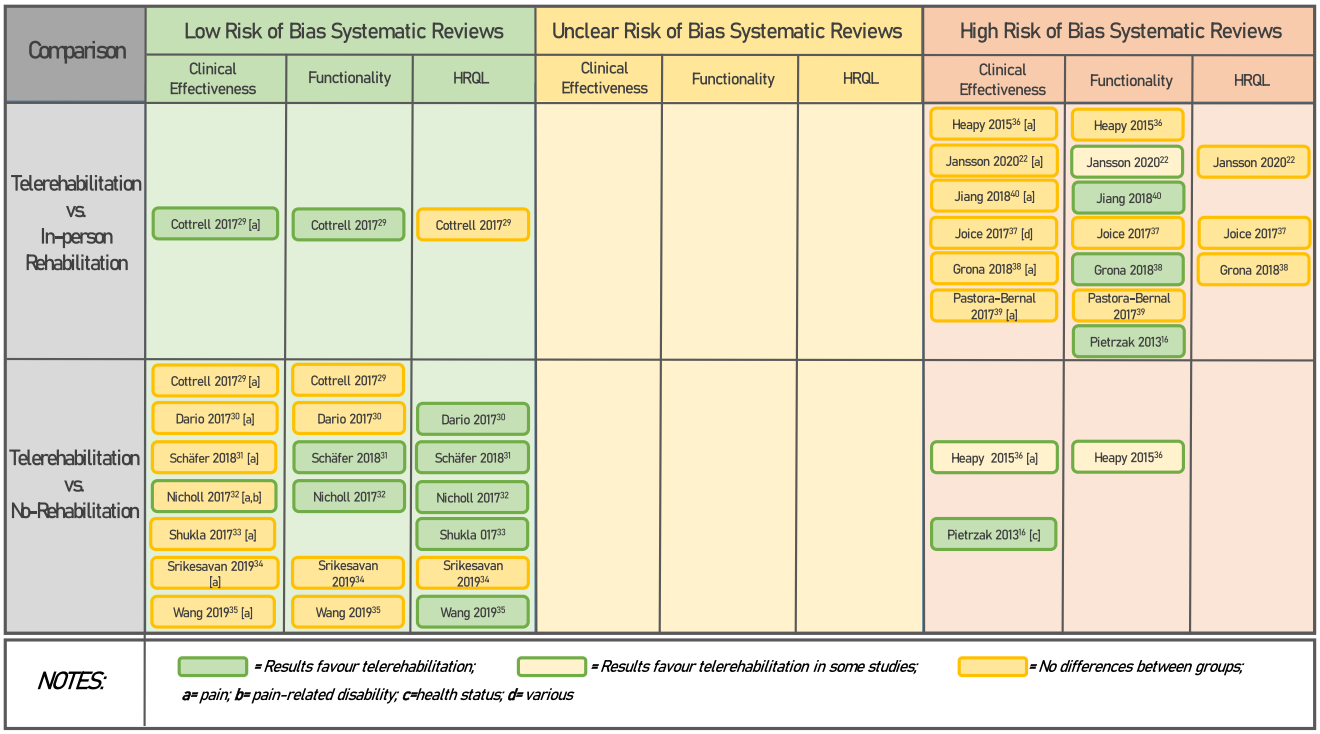

Figure 1. Summary of effectiveness results of telerehabilitation in musculoskeletal conditions by risk of bias assessment.

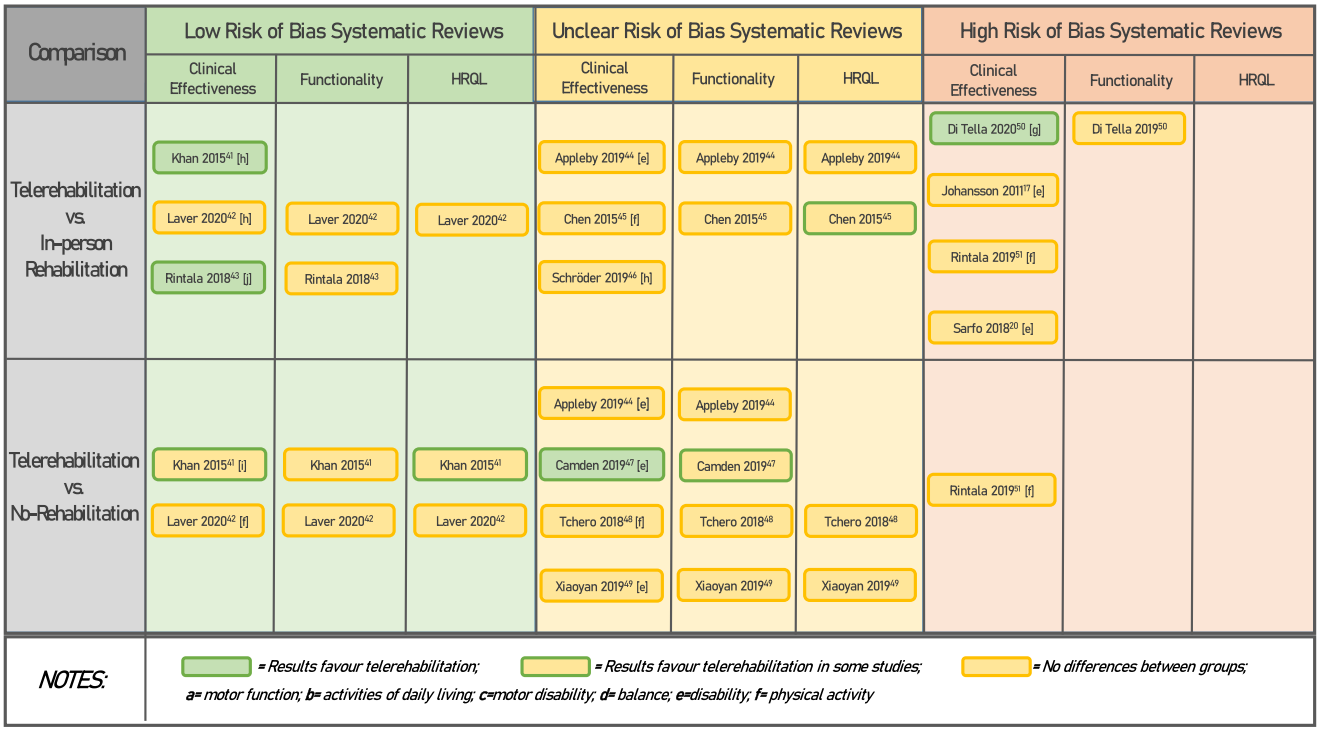

Figure 2. Summary of effectiveness results of telerehabilitation in neurological conditions by risk of bias assessment.

between telerehabilitation and no-rehabilitation groups for activities of daily living in stroke survivors.[51]

Cardiopulmonary Rehabilitation

A summary of results is presented in Figure 3. Four reviews were evaluated as having a low risk of bias. Only 1 review with patients with coronary heart disease found better results for the telerehabilitation group compared with in-person rehabilitation in clinical effectiveness measured as all-cause mortality.[52] On the other hand, 1 review with patients with COPD[53] and 2 reviews with coronary heart disease patients[54,55] reported no differences in clinical effectiveness between groups, regardless of the comparison group. One review included the HRQL outcome, reporting no differences between cardiac telerehabilitation and in-person cardiac

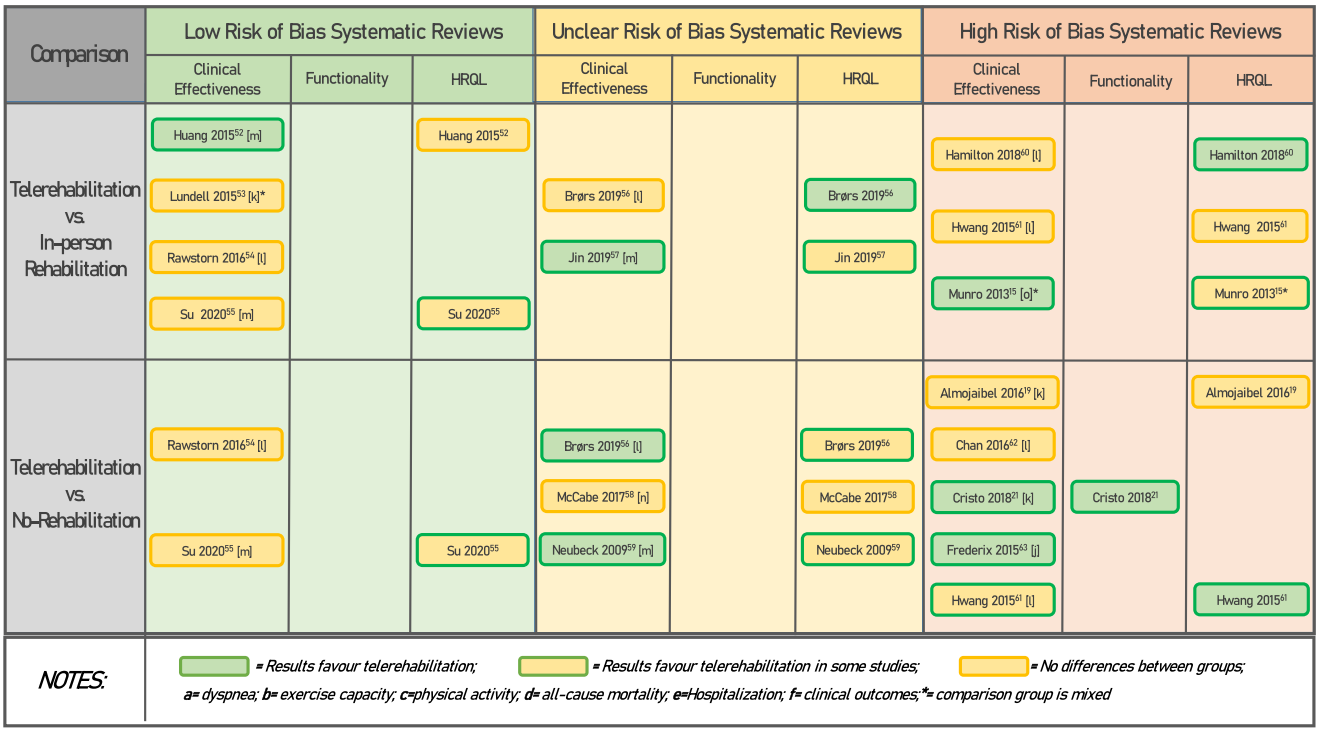

Figure 3. Summary of effectiveness results of telerehabilitation in cardiopulmonary conditions by risk of bias assessment.

rehabilitation,[52] and another review also about cardiac rehabilitation showed mixed results for HRQL for both telerehabilitation versus in-person and telerehabilitation versus no-rehabilitation comparisons.[55] Finally, 1 review showed better adherence for telerehabilitation compared with usual care.[54]

Another 4 reviews were evaluated as having an unclear risk of bias. Two of them, comparing telerehabilitation and in-person rehabilitation in patients with coronary heart disease, reported contradictory results. One review found a better HRQL in the telerehabilitation group and no> differences for clinical effectiveness measured as exercise capacity.[56] In contrast, the other review reported no differences between groups for HRQL in most of the primary studies included, but better clinical effectiveness measured as prevention of all-cause mortality.[57] On the other hand, for the telerehabilitation versus no-rehabilitation comparison, 2 and 1 unclear-risk-of-bias reviews showed better clinical effectiveness[56,59] with telerehabilitation and no difference between groups,[58] respectively. Two reviews reported better results for HRQL[56,59] in some primary studies included.

Seven reviews were evaluated as having a high risk of bias. Of these, 2 reviews[60,61] presented no differences between groups for exercise capacity when telerehabilitation was compared with in-person rehabilitation. One review[15] reported better results with telerehabilitation for clinical outcomes and same comparison, and mixed results were reported for HRQL.[15,60,61] For the telerehabilitation versus no-rehabilitation comparison, 2, 1, and 1 reviews showed better effectiveness for clinical outcomes,[21,63] functionality,[21] and HRQL,[61] respectively. Another 2 and 1 reviews reported no differences between groups for clinical effectiveness[19,62] and HRQL,[19] respectively. Finally, 1 review obtained mixed results for clinical effectiveness.[61]

Other Health Conditions

A summary of results is presented in Figure 4. Three low-risk-of-bias reviews evaluated telerehabilitation (more extensive than telemedicine) versus usual care. One reported clinical effectiveness to decrease body mass index,[65] another found that an eHealth intervention was effective at managing fatigue in cancer survivors,[64] and the last review, about overweight or obesity, reported lower weight regain in the intervention group.[18] Two reviews also compared telerehabilitation with an in-person intervention, 1 of them reported no differences between groups for physical capacity but better results for HRQL in the telerehabilitation group,[64] and the other found better clinical effectiveness with telerehabilitation.[18]

Three reviews evaluated as having unclear risk of bias and comparing telerehabilitation with in-person intervention reported no difference between groups for clinical effectiveness[8,66,67] and HRQL.[66] The same reviews also compared telerehabilitation with no intervention, and while one found no difference for pain and HRQL,[66] the other 2 reported mixed results for clinical effectiveness.[8,67]

Three and 1 reviews with a high risk of bias compared telerehabilitation with an in-person intervention and no intervention, respectively. From the first comparison, 1 reported a better result for clinical effectiveness measured as body mass index with telerehabilitation[69] and the other reported mixed results.[68] A third review showed better functionality in patients undergoing surgery and mixed results for HRQL in primary studies.[72] For the second comparison, 1 review found better glycated hemoglobin control in adults with type 2 diabetes with telerehabilitation.[70]

Finally, 1 review with no comparison identified reported mixed results for physical activity in cancer survivors.[71]

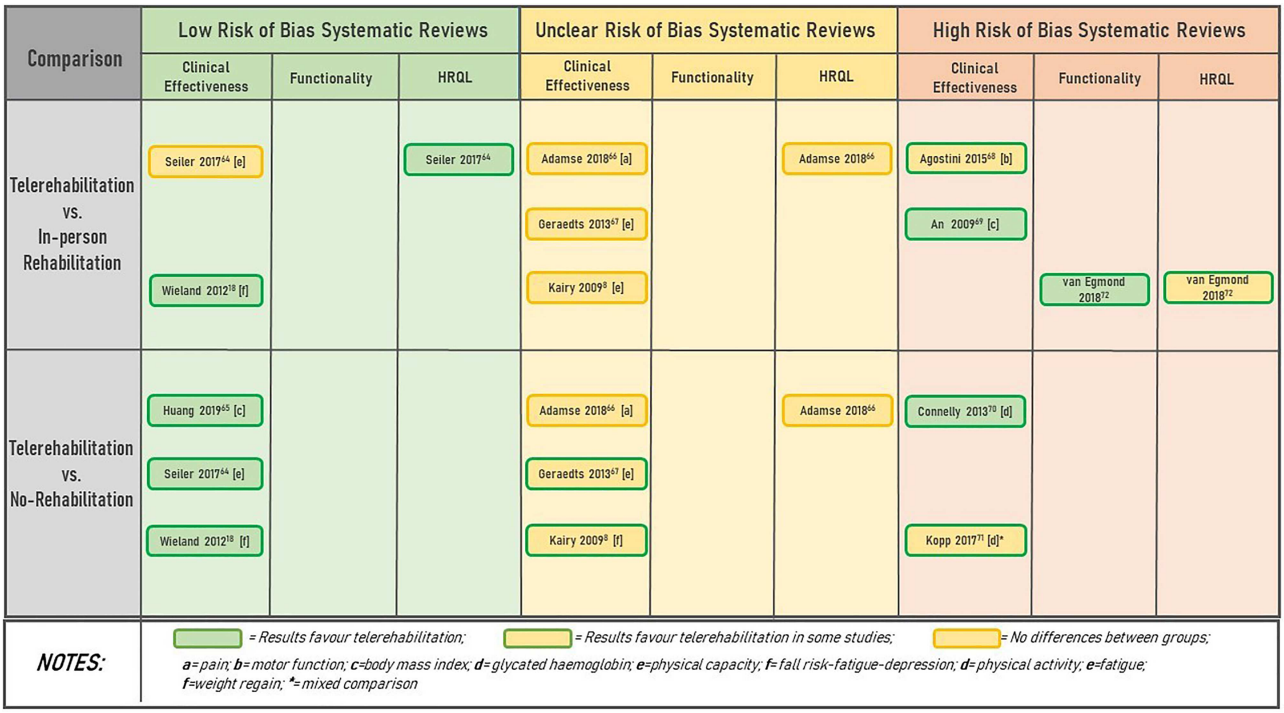

Figure 4. Summary of effectiveness results of telerehabilitation in others health conditions by risk of bias assessment.

Discussion

Fifty-three systematic reviews on telerehabilitation in physical therapy were included in this overview, 27 of which also included meta-analyses. These reviews covered different areas of the practice of physical therapy, mainly in the musculoskeletal, neurological, and cardiopulmonary areas.

Although there are global reviews and overviews that assess the effectiveness of telerehabilitation in some specific conditions,[7,13,73–75] to our knowledge this is first comprehensive overview that compiles results on the effectiveness of telerehabilitation, including various clinical areas in the remit of the physical therapist. This makes the available evidence so widely applicable in different areas of rehabilitation even more so today where, in addition to having greater access to various technologies, it has been made urgently necessary for such rehabilitation services to reach users without them having to leave the home because they are geographically remote and due to the COVID-19 pandemic. This latter global situation has clearly produced a collateral damage to the users of rehabilitation and physical therapy services.[76,77] The reported experiences in this scenario, although scarce,[78] reveal opportunities and challenges that must be faced, such as technological barriers, ethical and legal regulations, health insurance coverage, and cultural difficulties that preclude the understanding that telehealth and digital practice can be an effective means of rehabilitation.[79]

The population for which there is effectiveness data is mainly adult, with few studies on children or adolescents. In the musculoskeletal area, the conditions they address include chronic musculoskeletal pain, arthroplasties, osteoarthritis, and low-back pain in addition to surgically treated orthopedic conditions. On the other hand, in the area of neurorehabilitation, the evidence focuses on stroke and multiple sclerosis. In the cardiopulmonary area, the conditions are those typically included in cardiac rehabilitation, such as coronary disease, or pulmonary rehabilitation, such as COPD. In other health conditions, the most frequently addressed were cancer and ageing, with these being observed as emerging areas.

With respect to the means by which telerehabilitation is implemented, the most frequently studied is the use of the mobile telephone with its messaging services and telephone calls, with knowledge emerging of the effectiveness of the applications available on smartphones as a digital practice tool. The internet, including web pages mainly with educational content, videos, or interactive gaming, is also frequently studied. Studies have investigated electronic devices that are basically used as remote monitors with physical therapy interventions. Also studied were specialized platforms (eg, for videoconferencing), especially when synchronous communication is required. Finally, and especially in the neurological area, virtual reality has been positioned as an intervention tool, also within telerehabilitation, and was included in this work only if reviews explicitly stated that virtual reality was used outside a health center.

Other factors must be considered in the extrapolation of the results. One is the fact that the reviews generally include studies from the past 2 decades, during which there has been great technological growth at the same time as the widespread use of these media by the population, which makes the first studies in the area very different from the most recent. The other factor is that most of the reviews and their primary studies were concentrated in Europe, North America, and Oceania, with little information originating from low-resource settings, which could affect the feasibility of using the technologies on a more global scale because these may be the places that have the least access as well as conventional rehabilitation and would benefit most from its implementation and reduce health disparities.

Although the knowledge available with these systematic reviews is broad and up to date, care must be taken in the

interpretation of the results, basically due to the risk of bias present in the design process, conducting and analysis of the results from the systematic reviews, as well as the risk of inherent bias in the primary studies included in them. Only one-third of the reviews were assessed as having a low risk of bias, from which interpretations and extrapolations can be established with more certainty. Of these, however, in almost one-half of the clinical trials included, the evaluations of the quality or the risk of bias were deficient, which is why the uncertainty about the conclusions of the reviews continues to be high.

Although the establishment of the eligibility criteria, identification of primary studies, and data collection were not elements of great concern, the main issue with the systematic reviews included in this overview has to do with the process of synthesizing and interpreting the results. A specific aspect identified regards the results being synthesized in many reviews with no consideration as to which comparison groups were included in the clinical trials (eg, no rehabilitation or in-person or usual rehabilitation in a health center, an aspect that is a significant source of heterogeneity). To correct this problem to some extent, efforts were made to disaggregate data from the primary studies included in the reviews where it was feasible to do so, because tables were available, and there was a direct relation between the information they contained and the information in the text and the references of the studies, which only left a couple of reviews with a mixed comparison in results.

Another aspect of relevance in the interpretation of the findings was the lack of consideration of the risk of bias of the primary studies in establishing the conclusions of some of the reviews included, which may confuse readers, especially because the tendency in these cases is to overestimate the effects of telerehabilitation on physical therapy. One way to be able to draw valid conclusions in systematic reviews is to associate the results of the reviews or meta-analyses, that is, the estimator of the effect, their magnitude and accuracy, with the risk of bias. This is called certainty of evidence, which can be addressed in the process of interpreting the findings with the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) tool,[80] which was used in no more than one-third of the reviews included.

Consideration must be given to interpreting the results of no differences between groups, a finding present in more than one-half of the reviews. This may be due to the fact there were effectively no differences between the groups or to statistical power achieved with the sum of patients in the studies included in the reviews being insufficient to find differences. The importance here is that—although assuming that telerehabilitation is not inferior to in-person rehabilitation or, on the other hand, that telerehabilitation produces the same effects as not doing rehabilitation—caution should be taken in interpreting this finding in light of the accuracy of the results, that is, the size of the sample reached.

This overview has some limitations related basically to having been conducted as a rapid review, and within these limitations it should be recognized that the grey literature was not searched and that the data extraction process and evaluation of the risk of bias were not performed in duplicate, in addition to having been conducted by a large group of reviewers, which could have affected the reliability of the data. To minimize this bias, a second reviewer with experience in systematic reviews extracted data and assessed the risk of bias.

Another limitation to consider in the extrapolation of the results is the fact that physical therapy can be delivered alone or within a more comprehensive rehabilitation program. Although this distinction was not specifically considered in the selection criteria of most reviews or in the description of interventions, it could be observed that physical therapy was often provided with other rehabilitation interventions.

Although the aim of this overview was broad, it was possible to cover, but it must be clearly understood that the scope of the interventions included are about physical therapy and related with therapeutic or secondary prevention and not those of assessment or primary prevention.

Implications for Clinical Practice

The available evidence shows that telerehabilitation could be comparable or better than the conventional methods of rehabilitation to reduce pain and improve physical function in musculoskeletal conditions generally. Additionally, telerehabilitation could improve functionality in patients with osteoarthritis in the knee and non-specific low-back pain in addition to improving quality of life in patients with non-specific low-back pain, osteoarthritis in the knee, and total arthroplasty in the knee and hip.

In the area of neurorehabilitation, telerehabilitation seems to contribute to balance and to increasing the levels of physical activity in patients with multiple sclerosis, but its contribution in terms of balance, functionality, and quality of life in patients with stroke is unclear.

On the other hand, cardiac rehabilitation via telematic means is possibly better than in-person cardiac rehabilitation at reducing mortality by any cause and also seems to contribute to a better ability to exercise and HRQL. On the other hand, pulmonary telerehabilitation could have results similar to conventional rehabilitation in terms of reducing dyspnea in patients with COPD.

Finally, the interventions performed by physical therapists using technological media could be effective at reducing overweight and obesity as well as improving the physical capacity and quality of life in cancer survivors.

Clinicians must bear in mind that these conclusions come from 17 low-risk-of-bias reviews while there are another 36 reviews with methodological issues and contradictory results. Regardless of this, and in a context where it is not possible to perform center-based or in-person rehabilitation—because patients cannot access a health center, the health centers cannot provide services to all those who need it, or, during the COVID-19 pandemic, where outpatient or in-person services have been reduced or suspended in many health centers—telerehabilitation seems to be a suitable and feasible strategy to implement. On this point it must be recognized that the previously identified barriers had to be circumvented quickly, making it increasingly more likely that this form of rehabilitation service will become a new standard during and after this pandemic.

Implications for Research

This rapid overview provides evidence that it is necessary to continue research in the area of telerehabilitation. On the one hand, systematic reviews must improve their processes of planning, execution, and synthesis of results, incorporating solid methodologies such as the GRADE approach. Future overviews in specific clinical areas could incorporate a global quantitative synthesis of results, doing new meta-analyses and

even performing analyses of indirect comparisons. On the other hand, and perhaps most critically, is that clinical trials are conducted under strict considerations of internal validity and with optimal sample sizes. It is important to recognize that the results of a systematic review are only as valid as the results of the primary studies included. Another suggestion on this point is that non-inferiority studies be conducted, with their well-developed methodological particularities, so that they may conclude that telerehabilitation is not inferior to standard rehabilitation. Finally, a challenge to face is that these primary studies must be conducted in various resource settings, especially in the more precarious ones where there is less information.

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Systematic Review Registration

This protocol is registered in PROSPERO (CRD42020185640).

Disclosures

The authors completed the ICMJE Form for Disclosure of Potential Conflicts of Interest and reported no conflicts of interest.

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