Critical Reviews™ in Physical and Rehabilitation Medicine, 33(3):35–56 (2021)

Incorporating Exercise into Telerehabilitation Interventions for Adults with Chronic Low Back Pain: A Narrative Review

Ashley Morgan[a,*] & Julie Richardson[b]

[a]School of Rehabilitation Sciences, McMaster University, Hamilton, Ontario, Canada; [b]Department of Health Evidence and Impact, McMaster University, Hamilton, Ontario, Canada

*Address all correspondence to: Ashley Morgan, School of Rehabilitation Sciences, McMaster University, Institute of Applied Health Sciences, 1400 Main Street West, Hamilton, Ontario, Canada, L8S 1C7; Tel.: +905-525-9140; Fax: +905-524-0069, E-mail: morgaa2@mcmaster.ca

ABSTRACT: Telerehabilitation involves the use of information and communication technologies to provide rehabilitation care from a distance. Telerehabilitation can be a necessary and valuable means of providing rehabilitation services, especially in chronic conditions. Sufficiently detailed evidence is needed regarding how exercise can be effectively incorporated into telerehabilitation interventions for adults with chronic low back pain (CLBP). This narrative review outlines details on how and to what extent exercise is incorporated into published telerehabilitation interventions for CLBP considering the Consensus on Exercise Reporting Template (CERT) criteria. A search was conducted in EMBASE, MEDLINE, Cochrane CENTRAL, CINAHL, Google Scholar and the reference lists of relevant studies. Randomized controlled trials (RCTs) of telerehabilitation interventions for adults (> 18 years) with CLBP (> 3 months duration) were included for review. Eight RCTs, utilizing various technologies, were eligible for inclusion (793 screened). Results suggest many studies lack comprehensive descriptions of the exercise components of the intervention. All interventions include some form of monitoring, and more than half included goal setting, highlighting the importance of these components. Clinicians should consider including these components alongside exercise for telerehabilitation interventions for CLBP.

KEY WORDS: chronic low back pain, telerehabilitation, remote care, exercise

I. INTRODUCTION

Low back pain is the leading cause of years lived with disability worldwide.[1] Pain that persists beyond 3 months is considered chronic pain and can cause significant emotional distress and interference with one's ability to participate in daily life.[2] Depending on the sample, chronic low back pain (CLBP) is estimated to affect 4–25% of the adult population.[3] The current prevalence of low back pain is likely to be high worldwide given the increased numbers of individuals working from home with less ergonomic workspaces and challenges to being physically active due to restrictions to prevent the spread of coronavirus disease (COVID-19).[4,5] Clinical practice guidelines and systematic reviews[6–8] support the role of exercise in CLBP management. Therefore, comprehensive interventions for CLBP, regardless of mode of delivery, should strive to incorporate exercise.

Currently, amidst the COVID-19 global pandemic, chronic disease care (including rehabilitation) is negatively impacted due to a lack of resources[9] and frequently being deemed non-urgent.[10] To overcome these challenges, alternatives to in-person care are receiving more attention. Telerehabilitation uses information and communication technologies to deliver rehabilitation services to people remotely.[11] Telerehabilitation may include technologies as complex as robotics[12] and as simple as the telephone.[11] The use of technology is not new to rehabilitation[11] nor to CLBP care.[13] However, high-quality evidence on the effectiveness of telerehabilitation for CLBP appears to be limited.[13,14] A systematic review on web-based interventions for adults with CLBP reported overall small sample sizes, and suggested potential effectiveness for online cognitive behavioral therapy (CBT).[13] Another systematic review on digital self-management for LBP (any duration) reported significant heterogeneity among studies and a lack of well-described interventions.[14]

In each of these reviews, exercise was cited as a component in less than half of the interventions included and had minimal descriptions.[13,14] These results emerged despite recommendations from clinical practice guidelines[15,16] and systematic reviews.[6–8] The lack of an explicit exercise components reported in these reviews may be the result of more behavioral-focused interventions,[13] increased challenges in incorporating exercise into telerehabilitation interventions,[17] or generally poor reporting of the components of telerehabilitation interventions for CLBP.[14] Poor reporting of the components of an intervention is particularly problematic for the implementation of interventions.[18] Detailed reporting is important for the exercise components, as exercise prescriptions can vary significantly regarding type, intensity, duration and frequency.[19] The Consensus on Exercise Reporting Template (CERT) outlines necessary criteria for exercise interventions and was developed in response for a need for transparent, interpretable, and replicable exercise trials.[19]

Due to an increased need to conduct care remotely[9,10,17] and the lack of information available regarding exercise components of telerehabilitation interventions for CLBP,[13,14] there is a need for sufficiently detailed evidence on how to effectively incorporate exercise into telerehabilitation interventions for adults with CLBP. This narrative review utilizes the CERT criteria to assist in outlining how, and to what extent, exercise has been incorporated into telerehabilitation interventions for adults with CLBP. A narrative review is a scholarly summary of literature[20,21] that can serve several purposes including theory/model-building,[22] providing "how-to" information,[22,23] or identifying gaps in the literature.[20] It has been suggested that they are particularly useful for "addressing a topic in wider ways"[21] and deepening understanding.[21] Therefore, narrative review typology was deemed most suitable to the purposes of addressing questions of how, and to what extent, exercise has been incorporated into telerehabilitation interventions for adults with CLBP.

II. MATERIALS AND METHODS

A search was conducted in EMBASE, MEDLINE, Cochrane CENTRAL, CINAHL, Google Scholar and the reference lists of relevant studies from inception to November 2020. The search strategy was adapted for each database using the key concepts of "chronic low back pain" OR "chronic disease" OR "chronic pain" AND "telerehabilitation" AND "exercise." The Boolean operator "AND" was used to connect these key concepts. MeSH terms were used when available as well as key words. Alternative terms describing key concepts were included (e.g., "telemedicine," "internet-based intervention," "exercise therapy") and similar terms were combined using the Boolean operator "OR."

Randomized controlled trials (RCTs) of telerehabilitation interventions for adults (> 18 years) with CLBP (> 3 months duration) were included for review. Interventions included the use of information and communication technologies to provide rehabilitation care from a distance and had to be delivered completely remotely or be combined with a maximum of 1–2 in-person contact sessions. Interventions had to have an explicit exercise component to be included or to be a stand-alone exercise intervention. Therefore, studies reporting only "advice to keep active" were not included. Pre- or post-surgical interventions and interventions not specific to CLBP (i.e., general chronic pain, other chronic conditions) were excluded.

This review utilized CERT criteria[19] to help extract appropriate details from each intervention. The bulk of the subheadings in the manuscript are titled and organized according to the CERT criteria categories (what, who, where, how, when/how much, and tailoring).[19] To ensure the review met high quality standards, the Scale for the Assessment of Narrative Review Articles (SANRA)[23] was used to guide the review. SANRA's criteria includes justification of the article's importance, clearly stated aims, a description of the literature search, and appropriate referencing, scientific reasoning, and presentation of data.[23]

III. RESULTS

The search strategy yielded 793 articles after removal of 525 duplicates. The first author (AM) screened these title and abstracts and subsequently reviewed 32 full texts for eligibility. Eight RCTs detailing seven different interventions were included. A flow chart outlining these results can be found in Fig. 1.

A. Study Characteristics

Seven different interventions delivered using telerehabilitation that included exercise were included in the analysis. Eight articles were included to describe seven interventions as one intervention was published in two papers; one highlighting the efficacy of the intervention[24] and the other focusing on its cost-effectiveness.[25]

Sample sizes ranged from n = 47–229[24–26] and two of the RCTs included were identified as pilot studies.[27,28] Interventions took place in the United States (n = 2),[26,28] Australia,[27] India,[29] Switzerland,[30] Nigeria,[24,25] and Turkey.[31] The mean age of participants ranged from 41–70 years[28,29] across studies. Similar proportions of male and female participants were reported in two interventions,[27,30] predominately male (87[28] and 93%[28]) in two interventions, predominately (76%)[24,25] or exclusively female[31] in

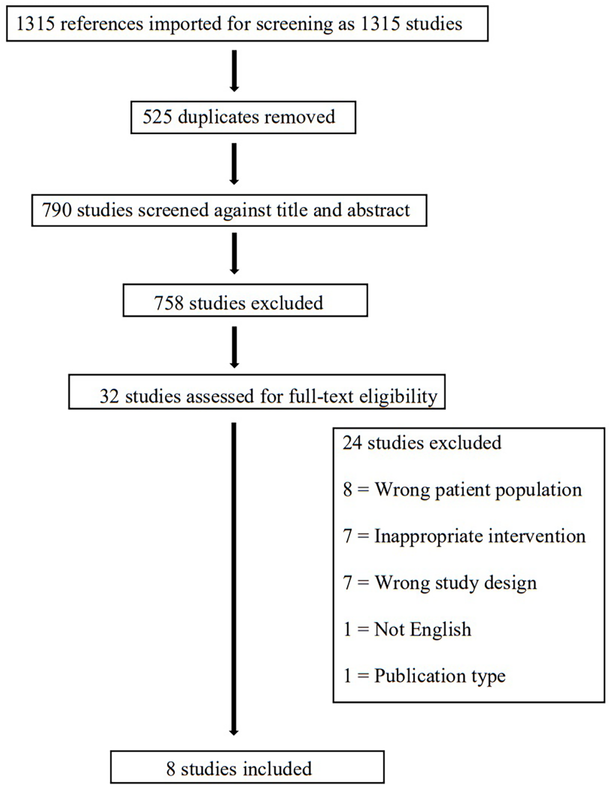

FIG. 1: Article selection flow diagram

two interventions and one intervention did not report the sex of participants.[29] One study's inclusion criteria specified CLBP duration as at least 6 months.[31] The intervention reported in papers by Mbada et al.[24] and Fatoye et al.[25] specified that participants were diagnosed by physiotherapists as having non-specific CLBP but did not outline how it was assessed nor the duration criteria (mean duration was 9.8 and 8.3 months in the intervention and control groups respectively).[24,25] The remainder of interventions specified > 3 months duration as CLBP criteria.[26–30]

The duration of interventions ranged from 6 weeks[31] to 1 year.[27] Telerehabilitation interventions were compared to a variety of control groups, including a group provided with a written exercise prescription,[29] a clinic-based exercise group,[24,25] and a group provided with a PA education booklet alone.[27] One study comparing a home exercise program with biweekly telephone calls to in-person exercise classes, considered the home program as the control rather than the intervention group.[31] Table 1 highlights the study characteristics, including a brief description of the intervention and control groups utilized. The mode(s) of telerehabilitation delivery are also highlighted in bold in Table 1. Although, the purpose of the present review is to focus on the specific details of exercise components of interventions, we have also included

TABLE 1: Characteristics of included studies

Study	Sample size at baseline (at follow-up)	Age: mean (SD)	Males/ females (%)	Duration	Intervention	Control
Alp et al.,[31] Turkey	48 (48)	Range: 36–63 I, 25–64 C	All female	6 weeks	Supervised in-person group exercise program focused on lumbar stabilization exercise	Home exercise program with biweekly phone monitoring
Amorim et al.,[27] Australia	68 (55)	59.5 (11.9) I, 57.1 (14.9) C	56/44 I, 56/44 C	6 months	One face-to-face meeting with a health coach to develop individualized PA plan, then phone contact every 3 weeks utilizing motivational interviewing and goal setting, provided with IMPACT mobile app and Fitbit activity tracker, PA booklet	PA booklet and advice to keep active
Chhabra et al.,[29] India	93 (93)	41.4 (14.2) I, 41 (14.2) C	Not reported	12 weeks	Written individual exercise prescription from physician, access to Snapcare app (activity monitoring, goal setting, reward points)	written prescription only
Fatoye et al.[25] and Mbada et al.,[24] Nigeria	56 (47)	47.3 (11.6) I, 50 (10.7) C	33/67 I, 23/77 C	8 weeks	McKenzie method extension protocol delivered via app developed by authors, included back care education, included phone and text message monitoring (frequency unknown)	McKenzie method extension protocol delivered in clinic, back care education instructions

TABLE 1: (*continued*)

Study	Sample size at baseline (at follow-up)	Age: mean (SD)	Males/ females (%)	Duration	Intervention	Control
Goode et al.,[28] United States	60 (50)	69.5 (3.5) I:PA, 69.5 (4) I:PA + CBT, 71.9 (6.5) C	95/5 I:PA, 90/10 I:PA+CBT, 95/5 C	12 weeks	PA: exercise prescription from PT at baseline and 4 follow up phone calls for goal setting and modification/ progressions, also provided with exercise video by Arthritis Society PA+CBT: as above plus weekly exercise counsellor phone calls and CBT education material	Waitlist
Krein et al.,[26] United States	229 (207)	51.2 (12.5) I, 51.9 (12.8) C	89/11 I, 86/14 C	12 months	Back class led by PT including exercises prior to randomization, internet-based program: pedometer uploading weekly, website (including goal setting, education, exercise videos) and online discussion group	Back class prior to randomization, pedometer uploading monthly
Riva et al.,[30] Switzerland	51 (51)	44 (13.6) I, 51 (14.1) C	48/52 I, 50/50 C	8 weeks	Interactive ONESELF website access including action plans and virtual gym	Static website access with library, first aid and FAQ

app, application; C, control; CBT, cognitive behavioral therapy; I, intervention; PT, physiotherapist.

Table 2 which highlights the outcomes measured in each study and statistically and/or clinically significant results.

B. Materials Used to Deliver the Intervention (What)

The types of technology utilized to deliver the overall intervention varied, and included websites (n = 2),[26,30] mobile phone applications (apps) (n = 3)[24,25,27,29] online discussion groups or comment boards (n = 2),[26,30] and telephone contact (n = 3).[27,28,31] Multiple forms of technology (e.g., website and telephone) were used in three interventions.[26–28]

The use of a pedometer or activity monitor was included to promote and/or monitor exercise in three studies.[26,27,29] Four interventions provided written information to supplement the exercise prescription.[26–29] Four interventions provided exercise images or videos via website, app or paper copy (images).[24–26,28,30] One intervention also provided an exercise video developed by the Arthritis Society as an aerobic activity option.[28] No studies reported any specific exercise equipment (e.g., weights, resistance bands) required by participants. The intervention by Goode et al. provided a list of exercise options, including chair stands, step-ups, cycling and swimming,[28] which suggests some flexibility in the materials required based on patient preference and availability.

C. Provider(s) of Exercise Instruction and/or Monitoring (Who)

Physiotherapists (PTs) were involved in exercise prescription in two interventions,[26,28] and a physician provided a written exercise prescription for participants in one intervention.[29] In another intervention, health coaches, who were described as having physiotherapy and exercise physiology backgrounds, were responsible for creating a physical activity (PA) plan, goal setting, and delivering coaching sessions.[27] For three interventions, exercise prescription was delivered through a website[30] or mobile-phone app.[24,25] The website[30] was developed in consultation with a team of rheumatologists and PTs while the mobile phone application was based on the McKenzie method.[24,25] The McKenzie method is a directional preference method (e.g., lumbar movement in a specific direction reduces symptoms) of assessment and treatment of LBP that is commonly used by physiotherapists.[24,25] Another study did not specify who delivered the exercise prescription but noted that it was the standard home program normally provided in the outpatient unit of a physical therapy and rehabilitation department.[31]

Some form of exercise monitoring occurred in every intervention; however, it was delivered in a variety of ways and not always from a specific provider. Emails, text-messages or mobile phone app notifications were used in five interventions[24–27,29,30] and phone calls in three.[27,28,31] A health coach delivered phone calls to assess progress, update goals, and discuss barriers and facilitators to participation in the intervention by Amorim et al.[27] Phone calls were delivered by a physiotherapist in the intervention by Goode et al.[28] The details of these calls were included in an appendix, and included review of exercise and activity goals, exercise program and modification and/or progression of the program.[28]

TABLE 2: Outcomes assessed and significant results

Study	Duration	Outcome collection	Outcomes	Significant results
Alp et al.[31]	6 weeks	Baseline and 3 months	**Daytime pain: visual analog scale (VAS) within home-based group (p = 0.007), stabilization group (p < 0.001),** between group difference (p = 0.385), **Krause-Weber abdominal endurance,*** Sorenson extensor endurance, **5 times sit to stand* Roland Morris Questionnaire (RMQ),* Short Form Health Survey-36(SF-36)***	Within group differences for both groups. Home-based group for VAS ($p = 0.07$), abdominal endurance ($p = 0.03$), sit to stand ($p < 0.001$), RMQ ($p = 0.005$), SF-36-physical function, physical role limitations, mental health, emotional role limitations, vitality and general health ($p = 0.002$ to $p = 0.049$). Between group differences for Short Form Health Survey -36 role limitations ($p = 0.041$) and Sorenson test ($p = 0.031$) in favor of stabilization (non home-based group)
Amorim et al.[27]	6 months	Primary: weekly for 6 months, Secondary: baseline and 6 months	Primary: care-seeking (survey), pain levels 0–10, activity limitation (weekly), Roland Morris Questionnaire Secondary: **International Physical Activity Questionnaire (IPAQ),**** objective PA over 7 days, **Goal Attainment Scale (GAS)****	**Pilot study:** Between group differences for IPAQ self-reported walking (183.1 minutes per week; 95% CI = 48.5–317.7, $p = 0.009$), GAS (odds ratio: 6.5; 95% CI= 1.9–22.5, $p = 0.003$)
Chhabra et al.[29]	12 weeks	Baseline and 12 weeks	Primary: **Numeric Pain Rating Scale (NPRS),* Modified Oswestry Disability Index (MODI)**** Secondary: **daily PA tracker,* Current Symptom Score (CSS)***	Within group differences for both groups for NPRS ($p < 0.001$), intervention app group: CSS and distance walked (p < 0.001). Between group differences for MODI (greater decrease in disability in intervention group) ($p = 0.003$).

TABLE 2: (*continued*)

Fatoye et al.[25] and Mbada et al.[24]	8 weeks	Baseline and 4 weeks, baseline, and 8 weeks	**Oswestry Disability Index (ODI),* Roland Morris Questionnaire (RMQ),* Short Form Health Survey-12 (SF-12),* pain: Quadruple Visual Analog Scale (VAS),* modified Biering-Sorenson for extensor endurance***	Within group differences for intervention app group at week 4 and 8: pain, RMQ, ODI, some SF-12 domains ($p < 0.05$), extensor endurance between week 4 and 8 ($p < 0.05$). Between group differences for SF-12 vitality domain ($p = 0.011$) at week 8 (in favour of app intervention), no other significant between group differences.
Goode et al.[28]	12 weeks	Baseline and 12 weeks	Primary: *Timed Up and Go (TUG), PROMIS Health Questionnaire* Secondary: Roland Morris Questionnaire, Satisfaction with Physical Function Scale, Patient Specific Function Scale (PSFS), Coping Strategies Questionnaire	**Pilot study:** Clinically significant changes in TUG scores: PA intervention (–2.94; 95% CI = –6.24 TO 0.25, effect size, Cohen's $d = -0.28$), PA + cognitive behavioral therapy (PA + CBT) (–3.26; 95% CI = –6.69 TO 0.18), $d = -0.31$), PROMIS scores: PA (–6.11, 95% CI = –12.85 to 0.64, $d = -0.64$), PA + CBT (–11.69, 95% CI = –11.69 to 3.48, $d = -0.43$). PA compared with CBT-P (favored PA group –2.00; 95% CI = –9.26 TO 5.26, $D = -0.23$), RMQ PA (–4.10; 95% CI = –6.85 to –1.34, $d = -0.78$), PA compared with PA + CBT (–2.10; 95% CI = –4.82 to 0.61, $d = -0.43$), PSFS: PA (3.64; 95% CI = –0.69 to 7.96, $d = 0.62$), PA + CBT (2.91; 95% CI = –1.55 TO 4.98, $d = 0.50$)
Krein et al.[26]	12 months	Baseline and 6 months, baseline, and 12 months	**Roland Morris Disability Questionnaire (RMQ),**** pain-related function measure: Medical Outcomes Survey (MOS) Secondary: pain intensity 0–10, steps per day in past week (pedometer), Fear Avoidance Beliefs Questionnaire-PA subscale, Exercise Regularly Scale (self-efficacy)	Between-group differences for intervention group for RMQ at 6 months (completed case analysis, adjusted between group difference 1.6, 95% CI = 0.3 to 2.8, $P = 0.02$)

TABLE 2: Outcomes assessed and significant results

Study	Duration	Outcome collection	Outcomes	Significant results
Riva et al.[30]	8 weeks	Baseline and 4 weeks, baseline, and 8 weeks	**Psychological Empowerment Scale,*** Prescription Medication Use and Perception of Risk Instrument, Short Questionnaire to Assess Health-Enhancing PA, **Chronic Pain Grading Scale (pain burden)***	Within group improvements for empowerment at 4 weeks (mean difference = 0.8, $p = 0.01$), pain burden in both groups (intervention group mean difference = –1.5, $p < 0.001$). Between group empowerment favored intervention group at 4 weeks, mean difference 0.7 ($p < 0.10$, effect size = 0.63)

Bold = reported as statistically significant improvement ($p < 0.05$ unless noted) for intervention or home-based group. *Italic* = reported as clinically significant improvement in intervention or home-based group. **Between group; *within group.

These results suggest that health care providers are often involved either directly or indirectly (e.g., website or app design) in the prescription of exercise in CLBP. Monitoring of exercise, however, was quite variable and less detail was given regarding providers. The majority of interventions utilized technological solutions like text messages or mobile app notifications, suggesting monitoring may be automated or delivered via research staff.

D. Locations Where Exercise Was Performed (Where)

No required location was specified for the interventions; therefore, all exercise was conducted in participants' homes or location of choice (e.g., neighborhood walking or cycling).

E. Delivery of Exercise (How)

All exercise components of the intervention were delivered to individual participants. However, pre-intervention, the study by Krein et al., required potential participants to complete a single "back class" prior to enrollment and randomization.[26] The "back class" was delivered in a group format and involved stretching and strengthening exercises adapted for each individual.[26,32] Information from the class, including exercises, was incorporated into the study website for participants in the intervention group.[26] Also, many programs included walking recommendations[26–29] so it is possible some participants chose to engage in activity with others. Exercise was largely unsupervised, with three interventions including in-person recommendations and/or goal setting at the beginning (or prior to) of the intervention.[26–28]

1. Exercise Description and Progression

Six of the interventions included specific home exercises, while one intervention developed individualized plans that were focused on increasing overall PA, largely through walking.[27] Half of the interventions that included specific home exercises did not describe them.[26,29,30] Three interventions provided some description of the exercises included.[24,25,28,31] Of these three, one intervention, utilizing the McKenzie method, described lumbar extension exercises in prone (lying face down) and standing and included exercise pictures from the app.[24] Another intervention by Alp et al. described "lumbar isometric and lumbar flexion-extension exercises (p. s37)"[31] but provided no other details. Finally, Goode et al. provided a list of exercise options (aerobic, stretching and strengthening) in an appendix that were used to design an individualized plan.[28] Descriptions of exercises included in each intervention can be found in Table 3.

Exercise progression was included in the form of increasing walking distance[26,29] or overall PA goals.[27] Of the six interventions that included specific home exercises, only half discussed any form of progression.[24,25,28,29] Only one of these interventions clearly outlined how and when progressions would occur (physical therapist [PT] phone calls

TABLE 3: Exercise descriptions, parameters, and progression in included studies

Study	Exercise description	Exercise parameters reported	Progression
Alp et al.[31]	Lumbar isometric and flexion-extension exercises	One set of 20 repetitions daily	None reported
Amorim et al.[27]	Individually tailored plan to increase general PA, Fitbit activity tracker provided	Based on goal setting with health coach	12 health coach phone calls (fortnightly) to assess progress, set short-term goals
Chhabra et al.[29]	Aerobic exercise daily goals for walking/ running, app tracks activity plus back exercises set by physician	General long-term goal of 4 km daily walk in a single stretch, 2 sets of 7 back exercises (daily)	Activity tracker used to assist in setting progressive PA goals (walking/running and home exercise program)
Fatoye et al.[25] and Mbada et al.[24]	Lumbar extension lying in prone, lumbar extension prone press-up, lumbar extension in standing	Extension lying in prone: 5 mins, up to 10 times, extension press-up hold 2 seconds, repeat up to 10 times	Prone: to forearms or hands (harder), can increase frequency but unclear who/how this will be determined
Goode et al.[28]	Individual prescription based on list of options, aerobic: walking, swimming, cycling, yoga, exercise video, strengthening mini-squats, chair stands, heel raises, hip abduction, step ups, core stability abdominal contraction with alternating hip flexion, stretching quads, calves, hamstrings, low back, hip flexors	Individually determined	Meet with PT every 4 weeks to modify or progress
Krein et al.[26]	Back class included strengthening and stretching exercises prior to randomization (videos included on website), walking goals using pedometer	Individual step count goals	Walking goals based on previous weekly average step count plus 800
Riva et al.[30]	Website includes "virtual gym"	None, notes action plan development (goal setting)	None reported

every 4 weeks).[28] Details (or lack of details) regarding the specific exercise parameters prescribed (e.g., frequency, intensity, time, and type) are described subsequently in the "when, how much" section of the paper. Information regarding progression description in each intervention can be found in Table 3.

2. Adherence

Exercise adherence was poorly reported across all studies despite the inclusion of some form of exercise monitoring incorporated into all interventions. Out of three interventions utilizing phone calls to promote adherence, only the study by Alp et al. reported the results, with 3 out of 24 participants reporting they did not complete their exercises every day.[31] The intervention detailed by Alp et al.,[31] was also the only one out of 5 interventions that included prescription of specific strengthening or mobility (e.g., stretching or range-of-motion) exercises[24–26,28,29,31] to report adherence to the specific exercises prescribed.

Four studies measured changes in PA via an activity tracker,[26,29] self-report,[30] or both.[27] These outcomes are appropriate to assess adherence if the interventions were based on increasing overall activity without a specific exercise prescription. However, all but one[30] of these four interventions reported utilizing individualized exercise plans. Whether the participants are achieved the recommended dosage of the individualized exercise prescribed was not reported. It is interesting to note that the intervention by Riva et al., which included an interactive website and "virtual gym" but no individualized plan, did not find improvements in self-reported PA.[30] The lack of improvement may suggest that individualized exercise prescription can help to increase overall PA. All three of the other interventions did show improvements in objectively measured activity[26,29] or self-reported walking.[27] However, the intervention by Krein et al.[26] was 12 months long and these improvements were noted at 6 months only.

3. Motivation Strategies

Almost all studies included some form of goal setting.[26–30] Motivational interviewing was used in two interventions[27,28] and development of action plans in two interventions.[28,30] Many interventions combined goal setting with other strategies like pedometer feedback[26,27,29] or "gamification" (collecting reward points via app or website for home exercise or educational purposes).[29,30] Monitoring, whether by phone, text, email, or app notification, occurred to some degree in all studies and could also be considered a motivational strategy to promote adherence.

4. Non-Exercise Components

All but one intervention[31] included components other than exercise, the most common being some form of standardized education which occurred in almost all of the interventions.[24–28,30] Education was delivered in a variety of ways, including through written materials[24–28] and websites.[26,30] Online discussion groups or forums were included in two interventions.[26,30] Cognitive behavioral therapy was also utilized in one arm of a pilot RCT by Goode et al., which compared three groups (exercise, exercise plus CBT, and a waitlist control).[28] The CBT sessions involved weekly phone calls from an exercise counsellor and the topics covered included activity pacing, breathing relaxation, distraction, progressive muscle relaxation, and cognitive restructuring.[28] The CBT sessions also included specific applications to exercise, such as overcoming pain-related barriers to exercise and managing pain associated with exercise.[28]

5. Adverse Events

Less than half the trials reported on the occurrence of adverse events. Two studies noted no adverse events had occurred[27,28] and one year-long trial noted 600 minor adverse events (350 in the intervention group) with increased back pain being the most commonly reported event for both intervention and control groups.[26] No major adverse events occurred during the year-long trial, and several methods of reporting were utilized, including collection via website, email, phone and regular web surveys.[26] No trial reported on any harms specific to the use of technology (e.g., patient privacy issues).

F. Dosage Recommended for Exercise (When and How Much)

No intervention specified the time of day during which exercises should be completed, however, the interventions that utilized action planning[27,28,30] may have included these details in participants' individualized plans. Recommendations for exercise dosage using the FITT (frequency, intensity, time, and type) were often ill-defined and frequently missing components. Aerobic activity, most commonly walking, was included in four interventions.[26–29] Five interventions include strengthening or mobility exercises.[24–26,28–30] However, whether exercises were designed for strengthening or mobility (e.g., stretching, or range-of-motion) was unclear in many trials that included no description beyond reporting inclusion of a "virtual gym,"[30] or a set of individualized home exercises.[26,29] Only one intervention clearly described utilizing both flexibility and strengthening exercises.[28]

Two interventions specified a daily number of sets and repetitions for the home exercises[29,31] and one intervention specified the exercises were completed up to 10 times but was unclear regarding how the number was determined for each individual.[25] Goode et al. specified that duration and number of repetitions was individually determined by the PT.[28] Among interventions that included walking, one intervention specified an overarching long-term goal of 4 kilometers per day[29] and another set daily goals based on adding 800 steps to the participant's previous weekly average step count.[26] Target intensity was not reported in any of the interventions included. Table 3 outlines the exercise parameters reported by each intervention.

G. Tailoring: Aspects of Tailored Exercise and How it is Accomplished

As noted previously, several interventions used an individualized approach in their activity recommendations. Tailored recommendations for specific strengthening and/or mobility exercises were provided in two interventions,[28,29] and walking distance or step counts in two interventions.[26,29] In one intervention, an overall PA plan was developed with the assistance of a health coach based on the participant's goals, abilities, and preferences.[27] Individualized strengthening and/or mobility exercises were prescribed at the beginning of the intervention by a PT[28] or physician[29] and modified or progressed by a PT during one intervention.[28] Walking distance or step goals were individualized during the intervention based on previous performance via activity monitoring.[26,29] Individualized goal-setting, which may also have been used as a form of tailoring, was included in five interventions.[26–30] Tailored messages via email, apps, or text messages were reported in three interventions.[26,27,29]

H. Extent to Which Exercise and/or PA has Been Incorporated into Telerehabilitation Interventions for CLBP

In the seven telerehabilitation interventions included, exercise was a key feature of almost all trials and other intervention components were often still related to exercise. For example, the CBT component utilized in Goode et al., was designed to apply specifically to exercise (barriers and challenges).[28] In two interventions there were minimal or no extra features beyond the exercise prescription.[24,25,31] However, in screening potential articles for review, five RCTs were excluded on the basis of not containing an explicit exercise component.[33–37] These results suggest that not all, but perhaps at least half, of published telerehabilitation RCTs for CLBP have incorporated exercise into their interventions.

IV. DISCUSSION

The review presented herein describes seven interventions that incorporated exercise into management for CLBP that were delivered via telerehabilitation, utilizing different technologies, providers, and methods of exercise prescription and delivery. Overall, moderate gaps were identified in comprehensive reporting of materials required and major gaps in reporting were identified regarding exercise description and parameters, as well as measuring adherence, and adverse events. All studies provided a comprehensive description of the technologies utilized and many included the use of exercise images or video recordings which may help to improve exercise performance accuracy.[38] However, improved clarity regarding materials requirement (e.g., exercise equipment) is needed, as a lack of access to these materials may be seen as a concern regarding implementation of exercise remotely.[17] The lack of reporting of materials utilized or required is consistent with results of a previous review which found "intervention materials" were the most frequently missing item.[39]

All but one intervention[27] included the prescription of specific exercises. However, more detailed descriptions of these specific exercises, including the parameters and modifications or progressions employed, would improve clarity, and facilitate transferability and implementation. Deficiencies in the descriptions of exercise parameters may be partially explained by the individualized nature of all or portions of the exercise recommendations.[26–29] For example, Amorim et al. described the development of individual exercise plans based on participant's goals, abilities and preferences,[27] while Chhabra et al. describe seven "back" exercises individually prescribed by a physician but neglected to describe these exercises or their parameters.[29] Reporting some basic parameters (e.g., starting repetition ranges, desired intensity, etc.) beyond just stating "individualized" would improve clarity, replicability, and allow comparison between different trials. Although individually tailored exercise may demonstrate greater effectiveness than standardized programs,[8] the reporting of tailored exercise requires greater transparency and detail. A strength of the RCT by Goode et al. was the inclusion of an appendix that listed the specific exercises that were options for the individualized plans.[28] However, reporting could have been improved by specifying all FITT principles (frequency, intensity, time, and type). Incomplete reporting of FITT principles is not an issue unique to CLBP interventions delivered via telerehabilitation, rather it has been reported as part of a larger, universal problem in the reporting of exercise interventions.[19,40] The omission of exercise specification related FITT has been identified by numerous reviews for a wide variety of conditions, including musculoskeletal conditions,[41–43] stroke,[44] hypertension,[45] and breast cancer.[46] The use of reporting guidelines such as Template for Intervention Description and Replication checklist (TIDieR)[18] and CERT[19] can help ensure these important components are included in exercise intervention reporting. Clinicians and researchers can consider these guidelines alongside quality assessment tools like the i-CONTENT tool for assessing therapeutic quality of exercise programs in RCTs.[47]

Adherence to an exercise program is often a challenge for adults with CLBP.[48–50] Despite using various monitoring and motivation strategies such as phone calls[27,28,31] or pedometer feedback[26,27,29] the degree of adherence to the prescribed exercise was poorly reported. Considering the phone monitoring of adherence that was reported in the study by Alp et al.,[31] nonadherence rates seemed surprisingly low (with only 3/24 reported not completing exercises daily). However, the intervention involved a generic prescription of 2 exercises (a static lumbar strengthening exercise and a lumbar range-of-motion exercise) and was only 6-weeks long[31] which may have supported adherence. The impact that duration of the intervention may have on adherence is also evident in the study by Krein et al.[26] Although Krein et al. reported changes in overall activity level rather than adherence to a specific exercise or PA prescription during their 12-month intervention, they found improvements in activity at 6 but not 12 months.[26] These observations are not surprising since the literature supports difficulties in long-term exercise adherence, particularly in chronic conditions.[51] Overall, exercise adherence reporting needs to be improved in telerehabilitation interventions for CLBP as adherence information is important for researchers and clinicians considering the feasibility of conducting similar strategies. Adherence can be assessed based on the degree to which an exercise prescription or recommendation is met which should be explicitly defined by the research team. Adherence is frequently assessed via self-report and strategies could include email or phone calls to obtain regular self-reports, written or mobile app exercise diaries/logs, and the use of activity trackers.

Finally, another major gap was a lack of adverse event reporting, which is problematic considering that a major concern in delivering exercise remotely relates to safety. Therefore, more attention to adverse reporting is needed. The Consolidated Standards of Reporting Trials (CONSORT) group highlights the importance of reporting harms in randomized trials[52] and the CONSORT-EHEALTH statement also specifies that web-based interventions should also include any privacy breaches or technological issues within the reporting of harms.[53] Future trials should consider the safety concerns specific to telerehabilitation (e.g., patient privacy) in conjunction with safety concerns specific to exercise interventions (e.g., muscle strains, acute and/or delayed muscle soreness, etc.). Interventions could follow the lead of Krein et al.[26,32] and consider a comprehensive strategy (e.g., multiple ways of collecting information such as website, email, or phone) to record adverse events. Transparent reporting of the occurrence or absence of adverse events for remotely delivered interventions is essential.

Despite the limitations identified in these interventions, critical information for designing future telerehabilitation trials and exercise interventions for CLBP is described in this review. The scope and implementation of telerehabilitation is described, the range of technologies utilized in the interventions implies that different modes of delivery could also be employed for different populations with differing levels of technological knowledge or access. For example, accessibility and technology requirements are greater for an exclusively web-based intervention, such as the interactive website intervention by Riva et al.,[30] whereas a telephone intervention is likely to be more accessible for an older population. No specific age-related challenges to adherence or participation could be linked to the use of technology; however, the intervention with the oldest sample, mean age > 60, utilized the telephone as the mode of delivery.[28]

Also, the results of the review suggest that a variety of strategies (phone calls, emails, text messages) can be used to monitor exercise and may not always need to be delivered by the health care provider. Using automated reminders may be a low-cost approach to promote adherence.[54,55] Further research is needed regarding how automated reminders impact adherence rates, however, there is existing evidence suggesting the effectiveness of mobile technologies on adherence for health care services[55] and in chronic disease populations.[54] Research also suggests tailoring these messages may be particularly important in behavioral change interventions.[56]

Finally, the inclusion of goal setting in more than half the interventions highlights the importance of this component. Goal setting is considered a key component of rehabilitation practice.[57] Goal setting is also included in the Chronic Care Model's description of self-management and is a common feature of self-management programs.[58] Assessment, "hands-on" treatment techniques, and exercise instruction, are more challenging than goal setting to adapt to remote modes of delivery.[17] The flexibility and variety of goal-setting strategies[58] are useful techniques to facilitate the delivery of rehabilitation interventions via telerehabilitation. However, to facilitate implementation and achievement of goals, clinicians and researchers should ensure all goal setting steps are included. A recent scoping review found 5 main goal setting phases; preparation, formulation of goals, action planning, coping planning and follow-up.[58] Only two interventions in the narrative review presented herein clearly specified formulation of an action plan[28,30] which is an important component of goal setting. These findings are similar to a review on the use of goal setting and action planning in self-management of chronic disease which found only 66% included action plan formulation.[58] To promote the utility of goal setting, clinicians and researchers should include steps beyond the formulation phase of goal setting.

V. LIMITATIONS

The relevant literature on exercise in telerehabilitation interventions for CLBP is currently limited, however this is likely to change given the recent focus on alternative modes of delivering care due to COVID-19. Additional information may be gained from other types of evidence. This review only included RCTs to allow for comparison across studies, using similar designs, which are subject to the same reporting guidelines (e.g., CONSORT statement).[59] Although the purpose of this review was not to determine effectiveness, significant outcomes reported in each RCT are presented in Table 2. Clinicians and researchers can refer to these studies and consider the detailed exercise component information provided in conjunction best practice evidence for treatment of CLBP.[15,16]

VI. CONCLUSION

The purpose of this narrative review was to outline how, and to what extent, exercise has been incorporated into telerehabilitation interventions for adults with CLBP. The topic may be particularly important as people have been working from home during the pandemic, spending many hours sitting and being sedentary in front of a screen which is likely to aggravate existing CLBP or may initiate symptoms. Clinicians and researchers can consider incorporating exercise into telerehabilitation interventions for CLBP using different types or combinations of technology ranging from simple to complex. Goal setting, the use of motivational interviewing, developing action plans, a monitoring plan and measuring adherence are important components to consider alongside exercise recommendations. Future research should be directed at improving reporting of exercise in telerehabilitation trials for CLBP to aid in interpretability and facilitate translation into practice.

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