Review

Efficacy of mHealth Interventions for Improving the Pain and Disability of Individuals With Chronic Low Back Pain: Systematic Review and Meta-Analysis

Bruna de Melo Santana1*, MSc; Julia Raffin Moura1*, BSc; Aline Martins de Toledo1*, PhD; Thomaz Nogueira Burke2*, PhD; Livia Fernandes Probst3*, PhD; Fernanda Pasinato1*, PhD; Rodrigo Luiz Carregaro1*, PhD

1Graduate Program in Rehabilitation Sciences, School of Physical Therapy, University of Brasília, Campus UnB Ceilândia, Brasília, Brazil
2School of Physical Therapy, Universidade Federal do Mato Grosso do Sul, Campo Grande, Brazil
3Unidade de Avaliação de Tecnologias em Saúde, Hospital Alemão Oswaldo Cruz, São Paulo, Brazil
*all authors contributed equally

Corresponding Author:
Rodrigo Luiz Carregaro, PhD
Graduate Program in Rehabilitation Sciences, School of Physical Therapy
University of Brasilia, Campus UnB Ceilândia
Centro Metropolitano
Brasilia, 72220-275
Brazil
Phone: 55 61 3107 8937
Email: rodrigocarregaro@unb.br

Abstract

Background: Low back pain is one of the main causes of disability worldwide. Individuals with chronic conditions have been widely affected by the COVID-19 pandemic. In this context, mobile health (mHealth) has become popular, mostly due to the widespread use of smartphones. Despite the considerable number of apps for low back pain available in app stores, the effectiveness of these technologies is not established, and there is a lack of evidence regarding the effectiveness of the isolated use of mobile apps in the self-management of low back pain.

Objective: We summarized the evidence on the effectiveness of mHealth interventions on pain and disability for individuals with chronic low back pain.

Methods: We conducted a systematic review and meta-analysis comparing mHealth to usual care or no intervention. The search terms used were related to low back pain and mHealth. Only randomized controlled trials were included. The primary outcomes were pain intensity and disability, and the secondary outcome was quality of life. Searches were carried out in the following databases, without date or language restriction: PubMed, Scopus, Embase, Physiotherapy Evidence Database (PEDro), the Cochrane Library, and OpenGrey, in addition to article references. The risk of bias was analyzed using the PEDro scale. Data were summarized descriptively and through meta-analysis (pain intensity and disability). In the meta-analysis, eligible studies were combined while considering clinical and methodological homogeneity. The certainty of evidence was assessed using the GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) criteria.

Results: A total of 5 randomized controlled trials were included, totaling 894 participants (447 allocated to the mHealth group and 445 to the usual care group), and they had similar methodological structure and interventions. Follow-up ranged from 6 weeks to 12 months. The studies did not demonstrate significant differences for pain intensity (mean difference −0.86, 95% CI −2.29 to 0.58; P=0.15) and disability (standardized mean difference −0.24, 95% CI −0.69 to 0.20; P=0.14) when comparing mHealth and usual care. All studies showed biases, with emphasis on nonconcealed allocation and nonblinding of the outcome evaluator. The certainty of evidence was rated as low for the analyzed outcomes.

Conclusions: mHealth alone was no more effective than usual care or no treatment in improving pain intensity and disability in individuals with low back pain. Due to the biases found and the low certainty of evidence, the evidence remains inconclusive, and future quality clinical trials are needed.

Trial Registration: PROSPERO CRD42022338759; https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=338759
Introduction

Low back pain is one of the main causes of years lived with disability in all people aged ≥18 years in the world [1] and causes serious socioeconomic problems due to its high health care costs in several countries [2-4]. For example, the annual costs for this health condition have been estimated to be approximately US $200 billion in the United States, including direct health care spending and indirect costs due to productivity losses and reduced quality of life [5]. In Brazil, between 2012 and 2016, the societal costs (treatment and productivity losses) arising from low back pain were estimated to be US $2.2 billion [6].

Low back pain is recognized for its high prevalence in all age groups ≥18 years. Globally, the prevalence of this condition was estimated to be at 7.5% in 2017, representing approximately 577 million people worldwide [7]. It is worth noting that people with low back pain are frequent users of health and social care services, which causes high expenses [6,8,9]. Thus, currently, one of the great challenges is to use effective strategies to manage this condition and avoid unnecessary expenses [9]. In this context, self-management of low back pain is recommended by international clinical guidelines [10,11]. This strategy involves care programs that facilitate the management and monitoring of the health condition itself, to enable the individual to manage symptoms as well as lifestyle changes [12-14]. It is recommended that self-management includes exercise and psychotherapy to limit the use of drugs and surgical procedures in clinical practice [11,15,16].

In the past decades, there has been a growth in the use of technological resources as a means for health promotion [17,18]. One of the main resources is mobile health (mHealth), which uses mobile and wireless technologies (eg, mobile phones, patient monitoring devices, and virtual assistants) [19,20]. One of the main advantages of mHealth is ease access and usability, as well as applicability in monitoring a health condition [21]. In addition, mHealth can encourage self-management actions; provide greater speed and practicality in the delivery of information; and promote adherence to treatment and other care, including for individuals with low back pain [22-24].

Despite the considerable number of apps for low back pain available in app stores, the effectiveness of these technologies is not established, and most are of low quality [25,26]. Notwithstanding, recent systematic reviews [5,27] have demonstrated positive results using eHealth (eg, the delivery of health resources via traditional internet and interventions with computer access) in the context of self-management of low back pain while considering different outcomes, such as pain and disability. Regarding mHealth, Chen et al [28] demonstrated that this modality combined with usual care (eg, SMS text messages, telephone calls, real-time monitoring, exercises, and counseling) improved the pain intensity and disability of individuals with low back pain. However, the review had limitations, including searches being restricted to the English language and possible selection biases (eg, there was no registration of the protocol, and the authors did not present a list of excluded studies during the full-text reading). Additionally, the review did not analyze the certainty of evidence nor discussed the impacts of the risk of bias of the included studies. Thus, there is a lack of evidence regarding the effectiveness of the isolated use of mobile apps, without interaction with therapists, in the self-management of low back pain.

Accordingly, this study aimed to synthesize updated data focusing on studies that investigated the use of apps for mobile devices (ie, smartphone back pain apps) as the only form of intervention for people with low back pain, without interaction with therapists. This aspect is relevant, given the impact of the COVID-19 pandemic and the subsequent increase in the number of apps available and the use of remote treatments [18,29]. Thus, the aim of this study was to investigate the effectiveness of mHealth interventions in improving the pain intensity and disability of individuals with chronic low back pain, compared to no intervention or usual health care strategies.

Methods

Overview

This systematic review is reported according to the recommendations of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement [30]. The protocol was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO; CRD42022338759).

Eligibility Criteria

Randomized controlled trials were eligible if they met the inclusion criteria, as defined in Table 1 according to the Population, Intervention, Comparators, and Outcomes question.

The search did not restrict the year or language of publication of the studies. Studies that investigated individuals with specific low back pain and studies that used apps with interference or contact with the therapist during the intervention period were excluded.
Assessment of the Risk of Bias

the screening by title and abstract. Any disagreement between

criteria. Any disagreements were resolved through discussion

The second selection phase was carried out by the same

process took place between December 13 and 26, 2022.

to the investigated condition (low back pain) were com-

and the search was individually adapted for each database

Inclusion criteria

Primary outcomes: pain intensity and disability

Secondary outcome: quality of life

Randomized controlled trials

Information Sources

Systematic searches were performed in the following
databases, with no restriction on publication date: MEDLINE
(via PubMed), Scopus, Embase, Physiotherapy Evidence
Database (PEDro), and the Cochrane Library, in addition to
gray literature (via OpenGrey [32]). The references of the
included studies were also screened, and the entire search
process took place between December 13 and 26, 2022.

Search Strategy

Search strategies were composed of controlled vocabulary
terms and words, according to each database. Terms referring
to the investigated condition (low back pain) were com-

combined with terms referring to the intervention of interest
(mHealth). No search filters were used for study design,
and the search was individually adapted for each database
(Multimedia Appendix 1). The search strategy was validated
by an experienced librarian.

Screening Process

The studies retrieved in the search were uploaded to Rayyan
software (Rayyan Systems Inc) [33]. After confirming and
deleting the duplicates, 2 reviewers independently performed
the screening by title and abstract. Any disagreement between
the reviewers at this stage resulted in the inclusion of the
study in the full-text reading stage. Authors of registered
protocols were contacted to confirm the publication of data.
The second selection phase was carried out by the same
reviewers independently, taking into account the eligibility
criteria. Any disagreements were resolved through discussion
and consensus.

Data Collection Process

The data extraction process of the included studies was
performed by 2 reviewers independently; they used a
previously prepared and standardized form for this review.

Data List

The information extracted included the sample size, the
intervention type of the experimental and control group,
the duration of the intervention, the outcomes, sources of
funding, and the declaration of conflicts of interest.

Assessment of the Risk of Bias

The risk of bias in the included studies was assessed using the
PEDro scale [34]. This step was performed by 2 independent
assessors, with subsequent consensus. The PEDro scale
contains 11 criteria to be considered from the study analysis,
and each item is equivalent to 1 point in the total score of the
final score ranges from 0 to 10, and the first item
(eligibility) must be disregarded in the score.

Effect Measures

The following effect measures were extracted from the
included studies: means and SDs for pain intensity, disability,
and quality-of-life outcomes.

Synthesis Methods

For the meta-analysis, the primary outcomes were considered.
To combine the results, the eligible studies were analyzed
while considering the clinical and methodological homoge-

neity and the follow-up period of the intervention. Mean
differences and 95% CIs were used as an effect measure
for the pain intensity outcome. For disability, standardized
mean differences and 95% CIs were calculated, grouped
with Hedges correction, in view of the differences in the
scales of the disability instruments adopted in the studies (eg,
differences in scales and direction of effects). The values
were multiplied by −1 to restore effect direction [35].

The random effects model with Knapp-Hartung adjustment
[36] was used in the calculation of both outcomes. Heteroge-

neity was assessed by visual analysis of the similarity of point
estimates and overlapping of CIs and using the \( \chi^2 \) test and \( I^2 \) measure. The results were considered heterogeneous when the
\( F \) values were >50% and \( P<.10 \) for \( \chi^2 \) values [35]. Meta-anal-
yses were performed using the SPSS software (version 29.0;
IBM Corp).

Assessment of Publication Bias

We planned to perform publication bias analysis if there were
more than 10 studies included in the same comparison, by
visual inspection of the funnel plot and the Egger statistical
test.

Assessing the Certainty of Evidence

Certainty in the final set of evidence was assessed using the
GRADE (Grading of Recommendations, Assessment,
Development, and Evaluations) criteria. The 5 items of the
GRADE criteria were analyzed: methodological limitations
(risk of bias), inconsistency, indirectness, imprecision, and
publication bias. Each of these criteria has items to be judged
through a qualitative assessment of the evidence for each

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analyzed outcome, allowing the classification of confidence in the estimate of effects as high, moderate, low, or very low, thus making it possible to reduce or increase the level of evidence [37]. In this evaluation, pain intensity and disability were considered critical outcomes. This evaluation was performed in GRADEpro software (McMaster University and Evidence Prime Inc).

**Adverse Events and Adherence**

We extracted information pertaining to the number of adverse events and intervention adherence in the included studies. Adverse effects were defined as unintended responses that occur during or after an intervention but are not necessarily caused by a causal relationship to the trial intervention. An adverse event was defined as an event for which the causal relation between the intervention and the event is at least a reasonable possibility [38].

**Results**

**Study Selection**

A total of 1824 publications relevant to the review were identified. After the exclusion of duplicates and selection by title and abstract, 18 were considered eligible for full-text reading, according to the inclusion and exclusion criteria. Subsequently, 5 publications [22,39-42] were included after the full-text reading (Figure 1). The 13 excluded studies during the full-text phase are described in Multimedia Appendix 2 with the exclusion justifications.

**Characteristics and Results of Individual Studies**

The included studies had a total of 894 participants (447 allocated to the mHealth group and 445 to the usual care group) and similar methodological structure and interventions. Follow-up ranged from 6 weeks to 12 months, and the studies evaluated the pain intensity and disability outcomes. The characteristics of the included studies and the findings are shown in Table 2. The studies were conducted in Jordan, India, Denmark and Norway, and Germany.
Table 2. Characteristics of the studies included in the review.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Included studies (reference and published year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Almhawi et al [39], 2020</td>
</tr>
<tr>
<td></td>
<td>Chhabra et al [22], 2018</td>
</tr>
<tr>
<td></td>
<td>Sandal et al [40], 2021</td>
</tr>
<tr>
<td></td>
<td>Toelle et al [41], 2019</td>
</tr>
<tr>
<td></td>
<td>Weise et al [42], 2022</td>
</tr>
<tr>
<td>Study design</td>
<td>Pilot RCT with follow-up at 6 wks</td>
</tr>
<tr>
<td>Protocol number (record)</td>
<td>NCT03994458</td>
</tr>
<tr>
<td>Country</td>
<td>Jordan</td>
</tr>
<tr>
<td>Study period</td>
<td>January to August 2019</td>
</tr>
<tr>
<td>Population</td>
<td>Office workers for more than 5 y between 30 and 55 y of age, with low back pain for more than 12 wk</td>
</tr>
<tr>
<td>Participants, n</td>
<td>39 (20 intervention and 19 control)</td>
</tr>
<tr>
<td>Analysis</td>
<td>Per protocol</td>
</tr>
<tr>
<td>Intervention</td>
<td>“Relieve my back” provides general advice, instructions, and stretching and strengthening exercises for lower back and abdominal muscles. Four phone notifications (sound and vibration with a pop-up window) were used to notify participants on taking breaks for walking, correct posture reminders, and exercise reminders.</td>
</tr>
<tr>
<td>Comparator</td>
<td>Placebo app (nutrition advice posts, along with 4 notifications: sound and vibration, along with a pop-up window with instructions) containing nutritional information unrelated to low back pain</td>
</tr>
<tr>
<td></td>
<td>Prescription drugs and their dosages and physical activity</td>
</tr>
<tr>
<td></td>
<td>Medical treatment and instruction to manage the condition according to clinician advice</td>
</tr>
<tr>
<td></td>
<td>Individual face-to-face sessions of standard physiotherapy once a wk (physical exercises and manual therapy). Encouragement to perform the physiotherapeutic exercises at home and to an active lifestyle. Weekly emails with a brief motivating message and links to medically oriented websites providing web-based resources for patient education about pathophysiology, diagnoses, treatment, and self-management in low back pain.</td>
</tr>
<tr>
<td></td>
<td>Physical exercises lasting 15 to 25 min, guided by a certified physiotherapist</td>
</tr>
</tbody>
</table>

[39] Almhawi et al [39], 2020
[22] Chhabra et al [22], 2018
[40] Sandal et al [40], 2021
[41] Toelle et al [41], 2019
[42] Weise et al [42], 2022

Pilot RCT with follow-up at 6 wks
RCT with follow-up at 12 wks
RCT with follow-up at 9 mo
NCT03798288
DRKS00022781
NCT03994458
Not reported
NCT03798288
DRKS00016329
DRKS00016329
DRKS00022781
NCT03798288
Not reported
DRKS00016329
DRKS00022781

Participants aged 18 y or older, with nonspecific low back pain for more than 8 wk
Participants with continuous pain for more than 6 wk
Participants >18 y of age, with nonspecific low back pain
Participants with nonspecific low back pain between 18 and 65 y of age, with continuous pain for more than 6 wk
Participants with nonspecific low back pain for more than 12 wk
Placebo app (nutrition advice posts, along with 4 notifications: sound and vibration, along with a pop-up window with instructions) containing nutritional information unrelated to low back pain
Prescription drugs and their dosages and physical activity
Medical treatment and instruction to manage the condition according to clinician advice
### Characteristics

<table>
<thead>
<tr>
<th>Duration of intervention</th>
<th>Included studies (reference and published year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 wk</td>
<td>Almhdawi et al [39], 2020</td>
</tr>
<tr>
<td>12 wk</td>
<td>Chhabra et al [22], 2018</td>
</tr>
<tr>
<td>6 wk</td>
<td>Sandal et al [40], 2021</td>
</tr>
<tr>
<td>6 wk</td>
<td>Toelle et al [41], 2019</td>
</tr>
<tr>
<td>12 wk</td>
<td>Weise et al [42], 2022</td>
</tr>
</tbody>
</table>

#### Outcomes

- Pain intensity: VAS
- Disability: ODI
- Quality of life: 12-item Short-Form Health Survey
- Sleep quality: Pittsburgh Sleep Quality Index
- Physical activity level: International Physical Activity Questionnaire
- Pain intensity: NPRS
- Disability: MODI
- Confidence in the ability to cope despite pain: Pain Self-Efficacy Questionnaire
- Fear-avoidance: Fear-Avoidance Beliefs Questionnaire, physical activity subscale
- Cognitive and emotional representations of disease: Brief Illness Perception Questionnaire
- Quality of life: EuroQol-5 Dimension questionnaire and EuroQol VAS
- Level of physical activity during leisure time: Saltin-Grimby Physical Activity Level
- General improvement: Global Perceived Effect Scale

#### Results

**At the 6-wk assessment**, pain intensity showed a significant reduction in the app group (mean 2.30, SD 2.13) compared to the control group (mean 5, SD 1.97; \( P<.001 \)). There was also a significant reduction in disability in the app group (mean 20.25, SD 13.47) compared to the control group (mean 52.1, SD 10.63; \( P=.002 \)). Regarding quality of life, there was a significant change in the physical component of the app group (mean 79.95, SD 16.09) compared to the control group (mean 62.26, SD 10.97). However, after 12 wk of intervention, the app group (mean 41.4, SD 18.8) registered a significant improvement in disability compared to the control group (mean 59.6, SD 17.2).

**At the 3-mo assessment**, pain intensity showed a reduction in the app group (mean 3.3, SD 2.2) compared to the control group (mean 3.9, SD 2.4; \( P=.001 \)) at the 3-mo assessment, and this effect was maintained at the 9-mo assessment.

**Regarding pain intensity**, no significant differences (\( P>.05 \)) were found between the groups over time. As for disability, the scores at baseline were significantly different between the groups: mean 52.1 (SD 14.4) for the app group and mean 20.2 (SD 17.8) for the control group (\( P=.03 \)). Nevertheless, after 12 wk of intervention, the app group (mean 41.4, SD 18.8) registered a significant improvement in disability compared to the control group (mean 59.6, SD 17.2).

**Regarding disability and quality of life**, no significant differences (\( P>.05 \)) were observed between the groups.

**Both groups reported a reduction in pain intensity over time**, but the app group reported a significantly lower pain intensity (mean 2.70, SD 1.51) at 12 wk compared to the control group (mean 3.40, SD 1.63; \( P=.02 \)). This effect was maintained at 9 mo, but in an attenuated form: mean 6.0 (SD 5.3) for the app group and mean 6.9 (SD 5.6).

**Regarding disability and quality of life**, no significant differences (\( P>.05 \)) were observed between the groups, although both showed improvement over time.
Based on data extraction, a summary of the results of the included studies was performed (Multimedia Appendix 3 [22,39-42]), containing the means and SDs for the pain intensity, disability, and quality-of-life outcomes. Overall, the studies reported benefits of mHealth in pain intensity, disability, and quality of life.

**Synthesis Results**

A meta-analysis was carried out for the pain intensity and disability outcomes, consisting of 4 of the 5 included studies [22,40-42] that adopted a follow-up of 12 weeks.

### Pain Intensity

Of the studies included in the meta-analysis, 3 studies [22,40,41] used the Numeric Pain Rating Scale [43] and 1 study [42] used the Verbal Numerical Rating Scale to assess pain intensity. Both scales assess and rate pain from 0 to 10 points, where 0 represents the absence of pain and 10 represents intense pain [44,45]. The effects were classified as low-quality evidence (Figure 2 [22,40-42]).
Disability

The Modified Oswestry Disability Index [22], Roland-Morris Disability Questionnaire [40] and Hanover Functional Ability Questionnaire [41] were used to assess disability. The effects were classified as low-quality evidence, and no significant differences were found between mHealth compared to usual care ($P=.14$; Figure 3 [22,40,41]).

**Figure 3.** Forest plot for disability (app: mobile health; control: usual care).

Risk of Bias of the Included Studies

The assessment of the risk of bias in the included studies is presented in Table 3. In all, 4 studies were classified with a final score of 7 and 1 study was classified with a score of 5. Overall, the nonblinding of participants and outcome assessors were common biases. It is worth noting that none of the included studies adopted the blinding of therapists.

**Table 3.** Risk of bias of included studies using the Physiotherapy Evidence Database (PEDro) scale.

<table>
<thead>
<tr>
<th>Studies</th>
<th>PEDro scale items</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toelle et al [41]</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Chhabra et al [22]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Sandal et al [40]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Almhdawi et al [39]</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Weise et al [42]</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

a1: Participants were randomly distributed.

b2: Concealed allocation.
c3: Initially, the groups were similar.
d4: All participants were blinded.
e5: All therapists administered the therapy blindly.

https://mhealth.jmir.org/2023/1/e48204
in favor of mHealth, and our meta-analyses showed no significant differences between mHealth versus usual care or no intervention (pain intensity: $P_{\alpha}=.15$ and disability: $P_{\alpha}=.14$). There were no reports of serious adverse events.

Even though our review demonstrated no significant differences between mHealth versus usual care or no intervention, the adoption of mHealth provided some beneficial effects in reducing pain intensity in people with low back pain. The combined effect of the included studies was approximately 0.9 (95% CI –2.29 to 0.58) points of improvement, demonstrating that a portion of the participants benefited, specifically those who had a score above 2 points [44]. Likewise, we found no significant differences in reducing disability, which was associated with a small effect size of 0.24 (95% CI –0.69 to 0.20) in favor of mHealth. However, the study by Almhdawi et al [39] investigated the use of a mobile app in office workers with low back pain and observed an effect size of Cohen $d=1.08$, which was considered large. It is worth noting that, despite the use of effect size measures in meta-analyses composed of standardized means, this interpretation is still considered conflicting [46]. In this context, previous studies have shown that the minimal clinically important difference in disability for low back pain is at least a 30% reduction in the score of the scales [47,48], and the findings of our study were below this threshold. Interestingly, Zheng et al [49] demonstrated that exercise combined with self-management training delivered via mHealth presents a faster improvement in disability when compared to exercise alone via mHealth. Thus, considering the findings of these previous studies, it is possible to assume that mHealth provides, to some extent, clinically relevant effects for the management of low back pain.

We found that the quality of life of the participants improved after the use of mHealth; however, this difference was not significant compared to usual care. Among the 3 studies that investigated quality of life, Sandal et al [40] and Toelle et al [41] found no differences between mHealth and usual care. These findings corroborate those of Schlicker et al [50], which also showed no significant differences between mHealth and usual care. The study by Zheng et al [51] investigated the effects of exercise delivered via mHealth, with and without a health education process, and found significant improvements in the physiological functional aspects of quality of life in both groups. Likewise, Almhdawi et al [39] found a large effect size in favor of mHealth (Cohen $d=1.18$), specifically for the improvement of the physical component of quality of life, but did not find improvement in the mental component. These results indicate that the effects of mHealth on quality of life are still conflicting. The quality of life is influenced by cultural, physical, and

Discussion

Our systematic review synthesized recent evidence on the use of mHealth technology in the management of individuals with low back pain. We found 5 studies totaling 894 patients, which reported positive effects on improving pain intensity and disability. However, we found a low certainty of evidence
social aspects, which makes it difficult to compare the results considering different contexts [52]. In addition, the improvement in the quality of life is more related to the improvement of disability than to pain intensity [53], and in our study, disability presented a small effect size, which may reflect the nonsignificant difference found for the quality of life.

A recent review [21] carried out a qualitative synthesis of the evidence on the perceptions and experiences of health professionals regarding the use of mHealth. The findings showed advantages arising from mHealth, such as the optimization of tasks, the speed of delivery of information, and the possibility of monitoring these patients remotely and recording data about their routine. Other studies [54,55] have shown that the satisfaction of patients who used digital interventions is similar to those who receive face-to-face care, with emphasis on the ease of use, efficiency in communication, and low cost, in addition to technology overcoming distance barriers. Another advantage is the fact that the technologies are based on active interventions, which focus on physical exercise and self-management—strategies that are considered effective to treat patients with musculoskeletal conditions [56]. Thus, mHealth can be a valuable tool for symptom control in patients with chronic low back pain. Nevertheless, factors such as adherence and the individual’s ability to manage their symptoms can have a determining effect on the clinical relevance of the results. In this sense, it is suggested that strategies that favor adherence and self-efficacy should be included in the service packages delivered by mHealth. Therefore, individualized strategies are recommended, given that the use of technological resources can be a positive factor for better adherence to treatment [57].

All included studies in our review showed some methodological biases. None of the 5 included studies blinded the therapists and 4 did not blind the patients [22,40-42]. It is noteworthy that 2 studies did not adopt concealed allocation [39,41]; 4 studies did not adopt the blinding of outcome assessors [22,40-42]; and in 1 study [22], the scores at baseline were significantly different between groups. The occurrence of biases is relevant because they may overestimate or underestimate the effect of interventions [58,59]. Concealed allocation refers to how participants are allocated to groups, and an inadequate allocation increases the estimate of effect size and can generate a difference in the investigator’s approach to participants, causing selection bias [60,61]. Studies that adopted an adequate binding process showed less predisposition to findings that favored a given intervention [62]. Thus, inadequate binding is a factor associated with biases and can alter the conduct of participants and researchers, who can change their behavior [63]. However, it is not always possible to blind therapists and participants, mainly due to the characteristics of interventions in certain areas (eg, the adoption of exercise and booklets) [64]. Two studies [39,41] did not perform the analysis of participants according to allocation; in these cases, participants who do not comply with the initial protocol are not considered, resulting in the loss of the benefits of randomization. This fact increases the risk of selection bias and the probability that changes are attributable to external factors or confounding variables [65].

Our review has the following strengths. Initially, we highlight the fact that we investigated the isolated effect of mHealth compared to usual care or no intervention in people with low back pain. This aspect reduced the risk of heterogeneity regarding the intervention and divergences in interpretations [66], which is contrary to previous studies [5,27,28]. Moreover, we took steps to minimize bias, such as including a minimum of 2 reviewers to independently assess the studies for inclusion and carry out the data extraction. In addition, 2 other independent reviewers carried out the risk-of-bias and certainty-of-evidence assessments. Furthermore, a comprehensive search strategy was adopted, comprising the major databases without language or date restrictions.

As a limitation, our review included a small number of studies due to the eligibility criteria, which favored the inclusion of a clinically homogeneous intervention. A second limitation was differences in the target audience of the included studies. The most heterogeneous study [39] carried out the research in a specific environment (ie, office), whereas the other studies included individuals from the general population. A third limitation concerns the biases present in the included studies, mainly the absence of concealed allocation and nonblinding of outcome assessors, which limited our conclusions. We also observed high heterogeneity in the pain intensity meta-analysis, which might be influenced by aspects related to the design and intervention characteristics of the included studies. For instance, the study of Weise et al [42] adopted a pragmatic trial, and the authors highlighted that the staff maintained close contact with the enrolled participants. Hence, this aspect might have influenced their intervention effects compared to the other trials [22,40,41]. Finally, owing to the small number of included studies, we have not performed sensitivity analyses.

Our review demonstrated no significant differences between mHealth interventions versus no intervention or usual care, neither on pain intensity and disability nor on quality of life. Notwithstanding, our findings suggest positive clinical effects from the use of mHealth in individuals with low back pain compared to no intervention or usual care. Owing to the biases found, the evidence remains inconclusive, and future high-quality clinical trials are warranted.

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Conflicts of Interest
None declared.

Multimedia Appendix 1
Search strategies adopted.  
[DOCX File (Microsoft Word File), 16 KB-Multimedia Appendix 1]

Multimedia Appendix 2
List of excluded studies, with reasons for exclusion after full-text reading.  
[DOCX File (Microsoft Word File), 18 KB-Multimedia Appendix 2]

Multimedia Appendix 3
Data related to the outcomes (mean and SD) during the intervention period of the studies included in the review.  
[DOCX File (Microsoft Word File), 22 KB-Multimedia Appendix 3]

Multimedia Appendix 4
Summary of findings table (Grading of Recommendations, Assessment, Development, and Evaluations).  
[DOCX File (Microsoft Word File), 17 KB-Multimedia Appendix 4]

Multimedia Appendix 5
Result of the assessment of the certainty of evidence for the primary outcomes (pain intensity and disability).  
[DOCX File (Microsoft Word File), 18 KB-Multimedia Appendix 5]

Checklist 1
PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist.  
[PDF File (Adobe File), 117 KB-Checklist 1]

References


**Abbreviations**

GRADE: Grading of Recommendations, Assessment, Development, and Evaluations

mHealth: mobile health

PEDro: Physiotherapy Evidence Database

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

PROSPERO: International Prospective Register of Systematic Reviews