Journal of Physiotherapy 71 (2025) 35–41

Journal of PHYSIOTHERAPY

journal homepage: www.elsevier.com/locate/jphys

Research

An e-learning program improves low back pain beliefs of physiotherapists: a randomised trial

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KEY WORDS

Low back pain
Beliefs
Physical therapists
Physical therapy
Randomized clinical trial

ABSTRACT

Question: How effective is an e-learning program based on international clinical guidelines in promoting beliefs more aligned with the current evidence for the management of low back pain among physiotherapists? **Design**: Randomised controlled trial with concealed allocation and intention-to-treat analysis. **Participants**: 106 physiotherapists who treat patients with low back pain. **Interventions**: The experimental group received access to an e-learning program, based on recommendations of clinical practice guidelines for the management of low back pain, over a 6-week period. The program consisted of six units, totalling 15 hours, and was offered in a self-instructional and self-paced format. The control group was instructed to continue their activities as usual. **Outcome measures**: The primary outcome was beliefs about low back pain measured using the Modified Back Beliefs Questionnaire (MBBQ, −50 worst to 50 best). Secondary outcomes included the Back Pain Attitudes Questionnaire (Back-PAQ, −20 worst to 20 best) and agreement with two statements (1: X-rays or scans are necessary to get the best medical care for low back pain; 2: Everyone with low back pain should have spine imaging). Participants were evaluated at baseline and 6 weeks. **Results**: Out of 53 participants allocated to the e-learning program, two completed only the first unit and one did not complete any units, resulting in an overall adherence rate of 94%. Compared with control, the e-learning program improved the MBBQ (MD 8 points, 95% CI 5 to 10) and the Back-PAQ score (MD 3.1 points, 95% CI 1.8 to 4.3). For the imaging beliefs statements, the e-learning program was able to increase the proportion of participants with beliefs aligned with the current evidence (statement 1: RD 38%, 95% CI 21 to 52; statement 2: RD 17%, 95% CI 7 to 29) compared with the control group. **Conclusion**: The e-learning program based on recommendations of clinical practice guidelines for the management of low back pain improved physiotherapists' beliefs about the management of low back pain. **Registration**: NCT05661968. **[Magalhães DS, McAuley JH, Maher CG, Ferreira EMR, Oliveira TEP, Mastahinich MER, de Jesus-Moraleida FR, Fukusawa L, Franco MR, Pinto RZ (2025) An e-learning program improves low back pain beliefs of physiotherapists: a randomised trial. *Journal of Physiotherapy* 71:35–41]**

Introduction

Low back pain is a prevalent condition globally.[1,2] According to the Global Burden of Disease Study, low back pain affected 619 million people worldwide in 2020, and it is estimated that this number could reach 843 million by 2050.[3] In Brazil, in 2016, $71.4 million was spent on direct costs related to spinal diseases, with 58% on hospital costs, 20% on physiotherapy services and 14% on imaging.[1] To reduce these impacts, it is important for healthcare professionals treating patients with low back pain to use evidence-based treatments.[4,5] However, many healthcare professionals, including physiotherapists, still have beliefs that are not aligned with current evidence regarding the management of low back pain.[6–8] A systematic review of 94 studies from 19 countries reported that approximately 43% of physiotherapists prescribe treatments that are not recommended by clinical practice guidelines, and up to 81% offer treatments that have not yet been evaluated for efficacy.[9] In addition, the prescription of treatments of unknown value by physiotherapists seems to be increasing in the last decades.[9] A recent population-based national survey[10] revealed that inequalities in back pain management are common in

https://doi.org/10.1016/j.jphys.2024.11.014

Brazil, with a significant proportion of the population – particularly those with lower education and socioeconomic status – not receiving evidence-based intervention.

The dissemination of clinical practice guidelines for the management of low back pain is a potential strategy to increase the adoption of evidence-based care.[5,11] Printed materials and brochures distributed by mail have not been shown to change the attitudes of healthcare professionals.[12] The uptake of and adherence to clinical practice guidelines by clinicians still face challenges.[13,14] Lack of time, inability to understand statistics, language barriers, lack of support from the employer, and personal behaviour barriers such as lack of interest or willingness to change clinical practice routines or acquire new knowledge are reasons often mentioned by clinicians for not following clinical practice guidelines.[13,14] Online education programs offered in an on-demand format may help overcome some of these barriers by giving clinicians flexibility and autonomy in their learning process. More recently, promising results have been documented by studies testing more visually engaging forms of content delivery such as videos, infographics and posts to change patients'[15,16] and clinicians' beliefs.[12]

An e-learning program, which provides a more interactive learning environment with resources to be used during clinical encounters with patients, may help to overcome some of the barriers reported by clinicians. This format may allow clinicians to engage more with the course content and improve their beliefs regarding the management of low back pain.

Therefore, the research question for this randomised controlled trial was:

> How effective is an e-learning program based on international clinical guidelines in promoting beliefs more aligned with the current evidence for the management of low back pain among physiotherapists?

Method

Design

The study design was a randomised controlled trial with concealed allocation and intention-to-treat analysis.

Participants

Recruitment of physiotherapists for the study was through social media platforms, including Instagram and Facebook. Physiotherapists interested in participating received information about the study either in person at their workplaces, such as physiotherapy clinics or outpatient facilities, or through telephone contact, via voice call or messaging apps. Physiotherapists were considered eligible for the study if they were licensed physiotherapists in Brazil and currently treating patients with low back pain in their clinical practice or had treated at least one patient in the last month, regardless of the symptom duration. Low back pain was defined as pain localised between costal margins and inferior gluteal folds, with or without referred pain to the lower limb.[5] Participants were excluded from the study if they reported not having access to or having difficulty accessing an internet network, as internet access was a prerequisite for participating in the e-learning program.

Procedure

After being deemed eligible for the study, participants were contacted via email to complete the Participant Information and Consent Form. Once participants filled out the form, they were provided with a link to collect the baseline data. The Research Electronic Data Capture (REDCap) system was used for data collection in the study.[17] The baseline data collected included sociodemographic information (ie, gender, marital status, years since graduation, type of employment and highest level of education), number of patients with low back pain treated in the last month, proportion of participants reporting having a history of low back pain, and knowledge about clinical practice guidelines for the management of back pain and using recommendations from these guidelines in clinical practice. At the end of the baseline assessment, data regarding the primary and secondary outcomes were collected.

After completion of the baseline assessment, each participant received a video call from the research team for randomisation purposes. Randomisation was conducted by opening the next sequentially numbered, opaque and sealed envelope during the video call. Participants were randomised to either the experimental group, which received the e-learning program, or the control group. Participants allocated to the experimental group received instructions via email to access the platform with the online education program. Six weeks after the initial assessment, both groups received a new email with the link to complete the follow-up assessment.

Participants in the experimental group were monitored during the 6-week online education program. A reminder was sent via a messaging app to participants in the experimental group every 3 days from the first day post-randomisation until participants signed in to the online education program for the first time. Participants who did not access the education program after 1 week were contacted via a telephone call. After the first access to the online platform, each participant was monitored and received weekly reminders through text messages via a messaging app. Participants allocated to the control group were instructed to continue their professional activities as usual and were not monitored weekly. Both groups were reassessed after 6 weeks.

Randomisation

The randomisation list was generated by an external researcher with no involvement in recruitment or determining participant eligibility. The randomisation sequence was created using block randomisation, with a 1:1 ratio, using random block sizes of 2, 4 and 6. The randomisation sequence was placed in sequentially numbered, opaque, sealed envelopes prepared by the external researcher. Recruitment occurred in four separate rounds throughout the study. The number of participants recruited in each round consisted of 24, 28, 18 and 36 participants. For logistic purposes, each round of participants started baseline data collection after the previous round finished the 6-week assessment. This strategy was adopted to enable better monitoring of participants in the experimental group throughout the study.

Interventions

Experimental group

Participants allocated to the experimental group were given access to a 6-week e-learning program. The content of the e-learning program was based on a previous study from our group, which compiled diagnostic and treatment recommendations consistently endorsed by current international clinical practice guidelines for the management of low back pain in primary care.[5] The program consisted of six units, totalling 15 hours, and was offered in a self-instructional and self-paced format. Participants were instructed to complete one unit per week, but they were free to complete the program at their own pace. The program content was elaborated using various resources such as video lectures, infographics, clinical cases, links to external websites and downloadable materials. Participants' access to the online program was provided via the Moodle platform[a]. Details of the e-learning program are described in Table 1. All units comprised an introductory text, followed by video lectures, infographics, clinical cases or links to external websites, and quizzes at the end of the unit for knowledge retention. The platform included a feature that required participants to complete a quiz for each unit before advancing to the next. A minimum pass rate of 60% was necessary to unlock the following unit, enabling progress monitoring throughout the study. Participants could attempt the quiz multiple times, but no answers or feedback were provided for incorrect responses. The e-learning program is available to Portuguese-speaking physiotherapists and allied health professionals at https://gforms.app/r/0q0o9a4.

Table 1
Content of the online education program used as the experimental intervention.

Unit	Content	Format/resource
Course introduction	Welcome to the course; general information about the course and outline of the program.	Text and introduction video
1: Epidemiology and diagnosis of low back pain	Epidemiology and individual and socioeconomic burden of low back pain	Informative text
	Diagnostic triage (ie, non-specific, specific and radiculopathy-associated low back pain), including assessment of red flags and physical examination (ie, dermatome, myotome and Lasegue tests)	Infographic for use in clinical practice
		Video lecture
		Article as supplementary reading material
2: Pain education and the role of imaging exams	Pain as a protective mechanism and it may be impaired in chronic low back pain Discussion on why routine prescription of imaging exams should be avoided	Video lecture
		Link to external website
		Clinical cases–text format
3: Assessment instruments and interdisciplinary approach	Importance of using self-reported questionnaires to assess the severity of low back pain symptoms, the risk of poor prognosis and the presence of psychosocial factors (eg, numerical pain rating scale, Roland Morris Disability Questionnaire, Oswestry Disability Index, Start Back tool, Orebro questionnaire, Tampa Scale for Kinesiophobia, Depression Scale)	PDF containing instructions to administer and interpret the results of questionnaires to be used in clinical practice
		Video lecture
	Information on the importance and use in practice of the interdisciplinary approach in the management of low back pain	Video lecture
4: Therapeutic recommendations and educational approaches	Content about the most effective treatments available for treating low back pain considering each group and the importance of education, counselling and self-management for patients	Infographic for use in clinical practice[15]
		Video lecture
5: Active and supervised exercise prescription	Information and practical examples of prescribing physiotherapeutic exercises and physical activity	Video lecture
6: Revision	Approach to reviewing the information provided in the course in a practical way and encouraging content retention	Educational video for patients[15] Portuguese version: https://youtu.be/wwaqG2sD_4g English version: https://youtu.be/HvcqG3dfp8A
		Clinical case
		Comic book–as supplementary reading material for patients

Control group

Participants allocated to the control group were instructed and guided to continue their activities as usual. At the end of the 6 weeks, participants from the control group were given access to the e-learning program.

Outcome measures

Primary outcome

The Modified Back Beliefs Questionnaire (MBBQ) assesses professionals' beliefs regarding low back pain.[18] This questionnaire was produced by combining two other questionnaires – the Back Beliefs Questionnaire and the Buchbinder Scale[19] – and the Brazilian Portuguese version has been shown to be reliable and valid when used by physiotherapists.[18] The MBBQ items encompass beliefs regarding the inevitable consequences of back pain, including aspects related to patients' work and social life, treatment (including medication, surgical procedures and alternative treatments), prognosis of back pain, causes of back pain and diagnostic methods. This MBBQ consists of 25 self-administered items, with each item rated on a Likert scale of 1 to 5 points (1 = completely disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = completely agree). The composite score of the questionnaire was used as the outcome of this study. To calculate the composite score, the Likert scale scores were transformed into a score ranging from –2 to 2 for each item. Thus, the total score of the questionnaire ranged from –50 to 50 points, with values closer to 50 points indicating more appropriate beliefs regarding low back pain.

Secondary outcomes

The Back Pain Attitudes Questionnaire (Back-PAQ)[20] was used as a secondary outcome. The Back-PAQ was recently translated and cross-culturally adapted into Brazilian Portuguese.[21] The Back-PAQ items encompass general aspects related to low back pain, including beliefs about behaviours related to pain and symptom recovery. The short version of the questionnaire with 10 items was used. Each item was scored on a Likert scale of 1 to 5 points; the total score of the questionnaire ranged from –20 to 20, with values closer to 20 indicating more appropriate beliefs. [21]

The participants' beliefs regarding the need for imaging exams were assessed through gauging participants' agreement with two statements. [22] Agreement with the two statements were measured on a Likert scale from 1 to 5 points (1 = completely disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = completely agree). The first statement was: X-rays or scans are necessary to get the best medical care for low back pain. The second statement was: Everyone with low back pain should have spine imaging (eg, X-ray, computed tomography or magnetic resonance imaging).

Sample size calculation

The MBBQ was used as the outcome to guide the sample size calculation. However, since this questionnaire has recently been developed and no previous clinical trials have used this measure as an outcome, the sample size calculation was based on data from two studies with pre/post-intervention study designs, with a single group.[19,23] These studies reported a mean increase of 14.4 and 15.4 points in the composite score of this questionnaire in medical students (ie, mean pre-intervention score = 5.8 points, SD 6.9; mean post-intervention score = 20.2 points, SD 9.2) and pharmacists (mean pre-intervention score = 11.9 points, SD 9.2; mean post-intervention score = 27.3 points, SD 9.9), respectively, immediately after a brief educational program (2 hours and 15 minutes). Data reported in a recent study[18] show that physiotherapists may have higher scores compared with medical students[19] and pharmacists,[23] which indicates that physiotherapists may have beliefs regarding back pain that are more aligned with the evidence. Considering that physiotherapists were the population in the present study, a difference of 5.5 points between groups in the composite score was estimated as

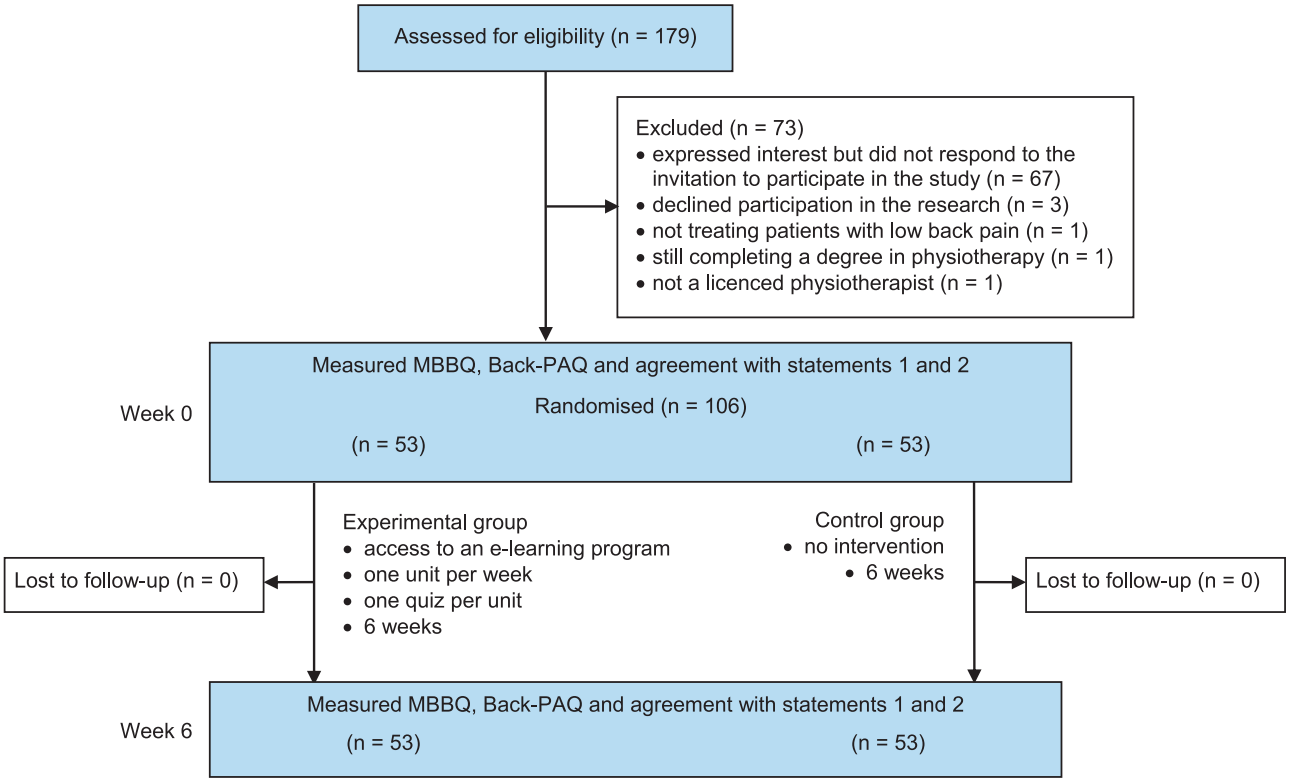

Figure 1. Flow of participants through the study. Back-PAQ = Back Pain Attitudes Questionnaire, MBBQ = Modified Back Beliefs Questionnaire

the between-group difference. This difference is approximately one-third of the pre/post-intervention effect previously reported with a standard deviation of 9.4 points (ie, standard deviation refers to the difference between groups in the composite score reported in a previous study).[23] Therefore, with a significance level of 5%, statistical power of 80% and a pre-determined sample loss of up to 15%, at least 53 participants per group were required to detect a mean difference of 5.5 points with a standard deviation of 9.4 points in favour of the experimental group.

Statistical analysis

Statistical analysis was conducted following the principle of intention-to-treat analysis, which means that participants were analysed in the group they were initially randomised to regardless of whether they received the assigned intervention. For descriptive purposes, dichotomous and categorical data, normally distributed data and non-normally distributed data were reported using frequency (proportion), mean (standard deviation) and median (interquartile range), respectively. For continuous outcomes, the MBBQ[18] and the Back-PAQ,[21] linear regression models for analysis of covariance were used to compare the mean effect between the experimental group and the control group. In this model, the groups were included as the independent variable, the post-intervention outcomes as dependent variables and the pre-treatment outcomes as covariates. Between-group comparisons were reported through the mean difference and their respective 95% confidence intervals.

Table 2
Characteristics of study participants at the baseline assessment.

Characteristics	Total (n = 106)	Exp (n = 53)	Con (n = 53)
Age *(y)*, mean (SD)	32 (9)	31 (7)	33 (10)
Sex, n female (%)	80 (75)	39 (74)	41 (77)
Marital status, n (%)			
single	58 (55)	32 (60)	26 (49)
married	43 (41)	20 (38)	23 (43)
divorced	2 (2)	0 (0)	2 (4)
other	3 (3)	1 (2)	2 (4)
Clinical experience *(y)*, n (%)			
0 to 5	62 (59)	33 (62)	29 (55)
6 to 10	21 (20)	10 (19)	11 (21)
11 to 15	11 (10)	5 (9)	6 (11)
> 15	12 (11)	5 (9)	7 (13)
Employment, n (%)			
public	11 (10)	2 (4)	9 (17)
private	31 (29)	13 (25)	18 (34)
public and private	15 (14)	9 (17)	6 (11)
own practice	33 (31)	24 (45)	9 (17)
public and own practice	16 (15)	5 (9)	11 (21)
Academic level, n (%)			
Bachelor's degree only	36 (34)	19 (36)	17 (32)
Specialisation course	65 (61)	31 (59)	34 (64)
Masters/Doctor	5 (5)	3 (6)	2 (4)

Con = control group, Exp = experimental group.
Percentages may not sum to 100% because of rounding.

Table 3
Experience of study participants with low back pain.

Experience	Total (n = 106)	Exp (n = 53)	Con (n = 53)
Patients with back pain treated in the last month, n (%)			
1 to 3	22 (21)	11 (21)	11 (21)
4 to 6	31 (29)	14 (26)	17 (32)
7 to 10	35 (33)	20 (38)	15 (28)
> 10	18 (17)	8 (15)	10 (19)
Follow back pain CPG recommendations in clinical practice, n (%)			
have no knowledge	39 (37)	17 (32)	22 (42)
yes	41 (39)	19 (36)	22 (42)
sometimes	26 (25)	17 (32)	9 (17)
History of low back pain, n (%)			
never had	12 (11)	7 (13)	5 (9)
at least one episode in the last 3 months	42 (40)	20 (38)	22 (42)
at least one episode in the last 6 months	18 (17)	10 (19)	8 (15)
at least one episode in the last year	13 (12)	7 (13)	6 (11)
at least one episode in over a year	21 (20)	9 (17)	12 (23)
Received prescription of imaging exam, n (%)			
never had low back pain	12 (11)	7 (13)	5 (9)
yes	20 (19)	10 (19)	10 (19)
no	74 (72)	36 (68)	38 (72)

Con = control group, CPG, clinical practice guideline, Exp = experimental group.
Percentages may not sum to 100% because of rounding.

Table 4
Mean (SD) of groups, mean (SD) within-group difference and mean (95% CI) between-group difference for questionnaires.

Outcome	Groups				Within-group difference		Between-group difference
	Week 0		Week 6		Week 6 minus Week 0		Week 6 minus Week 0
	Exp (n = 53)	Con (n = 53)	Exp (n = 53)	Con (n = 53)	Exp	Con	Exp minus Con
Modified Back Beliefs Questionnaire *(–50 to 50)*	26[a] (9)	25 (9)	35 (10)	26 (9)	10 (7)	2 (6)	8 (5 to 10)
Back Pain Attitudes Questionnaire *(–20 to 20)*	10.9 (5.7)	10.8 (6.5)	13.7 (5.7)	10.5[a] (6.8)	2.8 (3.9)	–0.3 (2.6)	3.1 (1.8 to 4.3)

Con = control group, Exp = experimental group.
Shaded row = primary outcome.
[a] n = 52.

Agreement with the statements related to the need for imaging for the management of back pain was reported descriptively according to the response on the Likert scale of 1 to 5 points, and the analysis was performed with dichotomised data, as described in the registered trial protocol. For data analysis, the responses were dichotomised into two categories: beliefs aligned with the current evidence (disagree and completely disagree) and beliefs not aligned with the current evidence (neither disagree nor agree, agree and completely agree) related to the prescription of imaging tests. The absolute risk difference and the 95% confidence interval were calculated to compare whether the experimental group was able to reduce the proportion of physiotherapists with incorrect beliefs compared with the control group. SPSS software[b] was used for data analysis.

Results

Participants for this trial were recruited between February and July 2023. A total of 179 physiotherapists expressed interest in participating in the study by replying to advertisements on social media. Of these, 73 physiotherapists were excluded for not meeting the eligibility criteria or not responding to the follow-up invitation to participate in the study and 106 participants were considered eligible and recruited (Figure 1). All participants who agreed to participate in the study received the intervention they were originally allocated after randomisation. One participant from the experimental group did not complete the MBBQ at baseline and one participant from the control group did not completely respond to the Back-PAQ at the 6-month follow-up. Data from both participants were not included in the analysis.

Characteristics of included participants and their experience with low back pain are described in Tables 2 and 3. The mean age of the study participants was 32 years (SD 9), with the majority (75%) being female. More than half of the participants (59%) reported having up to 5 years of clinical experience, about a third of the participants worked in their own practices (31%) or in other private practices (29%), and most participants (61%) reported undertaking a specialisation course after completing their bachelor studies (Table 2). Approximately two-thirds (63%) of the participants reported having knowledge about clinical practice guidelines, and 39% reported using the guideline recommendations in clinical practice (Table 3).

Fifty (94%) participants in the experimental group completed all units of the e-learning program. Three participants did not complete the program: two completed only the first unit and one started the program but did not complete any units.

Primary outcome

The results showed that the group receiving the e-learning program increased on average by 8 (95% CI 5 to 10) points in the MBBQ questionnaire compared with the control group, meaning that the e-learning program was effective in promoting more beliefs aligned with current evidence in the experimental group compared with the control. Table 4 shows the baseline and 6-week follow-up data for each group and the between-group comparison.

Secondary outcomes

The result of the Back-PAQ questionnaire showed that the group receiving the e-learning program increased on average by 3.1 points (95% CI 1.8 to 4.3) compared with the control group, indicating an effect for promoting beliefs aligned with the current evidence in the experimental group (Table 4). The responses of the participants for the two imaging statements are described in Tables 5 and 6. For statement 1, 48 (91%) participants allocated to the experimental group showed beliefs aligned with the current evidence at the end of the study compared with 28 (53%) participants in the control group (risk difference 38%, 95% CI 21 to 52). For statement 2, the results were similar, with 53 (100%) participants in the experimental group showing beliefs aligned with the current evidence compared with 44 (83%) participants in the control group (risk difference 17%, 95% CI 7 to 29).

Individual participant data are available in Table 7 on the eAddenda.

Discussion

The results demonstrated that the e-learning program was more effective in promoting beliefs aligned with current evidence regarding low back pain management and imaging prescription than the no-intervention control. The group that received the e-learning program showed an increase of 8 points (95% CI 5 to 10) in the MBBQ compared with the control group. Results for secondary outcomes also favoured the e-learning program. The findings suggest that e-learning programs can be useful for improving physiotherapists' knowledge about evidence-based management of low back pain and

Table 5
Number (%) of participants with beliefs aligned with the current evidence according to each statement at Weeks 0 and 6, and absolute risk difference (95% CI) between groups at Week 6.

Statements	Groups				Absolute risk difference (95% CI)
	Week 0		Week 6		Week 6
	Exp (n = 53)	Con (n = 53)	Exp (n = 53)	Con (n = 53)	Exp minus Con
X-rays or scans are necessary to get the best medical care for low back pain, n (%)	29 (55)	30 (57)	48 (91)	28 (53)	0.38 (0.21 to 0.52)
Everyone with low back pain should have spine imaging (eg, X-ray, CT or MRI), n (%)	43 (81)	42 (79)	53 (100)	44 (83)	0.17 (0.07 to 0.29)

Con = control group, CT = computed tomography, Exp = experimental group, MRI = magnetic resonance imaging.

Table 6
Proportion of participants with correct and incorrect beliefs for the questions regarding imaging prescription at Weeks 0 and 6.

Degree of agreement	X-rays or scans are necessary to get the best medical care for low back pain				Everyone with low back pain should have spine imaging (eg, X-ray, CT or MRI)			
	Week 0		Week 6		Week 0		Week 6	
	Exp (n = 53)	Con (n = 53)	Exp (n = 53)	Con (n = 53)	Exp (n = 53)	Con (n = 53)	Exp (n = 53)	Con (n = 53)
Completely agree	3 (6)	2 (4)	0 (0)	1 (2)	1 (2)	0 (0)	0 (0)	0 (0)
Agree	6 (11)	8 (15)	4 (8)	9 (17)	3 (6)	3 (6)	0 (0)	2 (4)
Neither agree nor disagree	15 (28)	13 (25)	1 (2)	15 (28)	6 (11)	8 (15)	0 (0)	7 (13)
Disagree	11 (21)	19 (36)	21 (40)	14 (26)	14 (26)	21 (40)	9 (17)	17 (32)
Completely disagree	18 (34)	11 (21)	27 (51)	14 (26)	29 (55)	21 (40)	44 (83)	27 (51)

Con = control group, CT = computed tomography, Exp = experimental group, MRI = magnetic resonance imaging.

imaging prescription; therefore, they may be good options for disseminating current knowledge about low back pain.

Previous studies have investigated the effect of brief education interventions on MBBQ scores. One study assessed the effect of a 2-hour educational workshop for pharmacists[23] and another study assessed the effect of a 15-minute video including aspects of back pain education for medical students;[19] these studies showed an improvement in the MBBQ score from before to after the intervention. An important limitation of these previous studies was that they were not randomised controlled trials, so whether the improvement in the participants' beliefs was due to the intervention itself cannot be determined. Another difference is that the 6-week e-learning program that was examined was much longer than the interventions in the uncontrolled studies (ie, a 2-hour workshop and a 15-minute video). A 6-week e-learning program may provide clinicians with sufficient time to retain the course content, potentially leading to more sustained changes in beliefs than those produced by brief interventions such as workshops or videos. However, the efficacy of the online education program was only assessed in the short term (ie, immediately after the end of the intervention). Future studies are needed to determine whether online education programs can maintain these changes in beliefs over a longer period.

The self-instructional nature of the e-learning program tested in this trial allowed participants to determine their own learning pace according to their time availability. Considering that lack of time is one of the most common barriers for health professionals to stay up to date with the evidence,[13,14] the online and self-instructional format may be a good option to overcome this barrier. A previous randomised trial testing an online educational program with physiotherapy students found no difference between working at their own pace compared with being guided by experienced facilitators in knowledge acquisition about spinal cord injuries.[24] Therefore, online self-instructional educational programs might have the advantage of using fewer resources and being more generalisable to a wider community of physiotherapists. This type of self-instructional e-learning program could be seen as a complementary program for undergraduate students, as evidence suggests that adherence to guideline recommendations, while improving over time, remains suboptimal.[25] Furthermore, given that the course content shares similarities with the proposed low back pain curriculum content standards,[26] this e-learning program could be embedded within undergraduate physiotherapy programs to ensure that graduating physiotherapists have adequate knowledge to assess and manage low back pain.

A limitation of this study is that it was unable to track whether participants in the experimental group performed all proposed activities (ie, reading texts and watching videos) within the e-learning program. Although the platform tracked participants' progress throughout the online content, we cannot guarantee that they spent the time required to read and complete all activities. A possible way to monitor that is to use tools that can record the amount of time participants spend on each page or activity. The quizzes at the end of each unit of the program were implemented as a strategy to ensure consolidation of the content by the participant. Another limitation is that a process evaluation was not conducted alongside the trial to investigate whether modifications or adaptations to how the content was structured or delivered are required. However, including a mixed population with diverse clinical experience, employment status and academic backgrounds suggests that the e-learning program might be suitable for a wide range of physiotherapists. Evidence from previous studies suggests that e-learning programs are often acceptable to physiotherapists and other allied health professionals.[27,28] Future studies should assess the user experience with the e-learning program before progression to wide implementation of the program.

In the current study, the control group was instructed to keep practising as normal. Hence, physiotherapists were expected to maintain their normal social media and browsing habits. The results showed that participants' beliefs in the control group remained relatively stable at 6 weeks compared with baseline. This was unsurprising because most information available elsewhere on the internet[29] and social media[30] is generally questionable and not based on high-quality evidence, and physiotherapists often report a lack of time and evidence-based practice skills to keep up to date with the literature. The findings suggest that e-learning programs might be an effective intervention to improve physiotherapists' knowledge compared with a no-intervention control. In addition, the within-group effect on the MBBQ (ie, primary outcome) in the e-learning group was greater than the minimal detectable change of 6.7 points,[18] indicating that the average improvement exceeded the anticipated measurement error and variability. However, for the secondary outcome, the within-group effect on the Back-PAQ did not exceed the minimum detectable change of 5.6 points.[21] Further research is needed to determine whether this e-learning program should be broadened to address beliefs assessed by other questionnaires, result in long-term knowledge retention, and lead to improvements in clinical outcomes.

In conclusion, the findings support the use of an e-learning program to update physiotherapists' knowledge regarding evidence-based management of low back pain. A 6-week e-learning program (ie, 15 hours in total) should be seen as an effective intervention to promote low back pain and imaging beliefs aligned with current evidence among physiotherapists who treat patients with low back pain.

What was already known on this topic: Many physiotherapists and other healthcare professionals still have beliefs that are not aligned with current evidence regarding the management of low back pain. Simple distribution of clinical practice guidelines has not been shown to change the attitude of healthcare professionals towards management of low back pain.
What this study adds: A self-paced e-learning program consisting of 6-week modules improved physiotherapists' beliefs about: low back pain; behaviours related to pain and symptom recovery; and the need for imaging.

Footnotes: [a] IBM SPSS V.20.0, IBM Corporation, Somers, USA.
eAddenda: Table 7 can be found online at https://doi.org/10.1016/j.jphys.2024.11.014
Ethics approval: The Research Ethics Committee for Human Studies at the Federal University of Minas Gerais approved this study

(CAAE 60756422.6.0000.5149). All participants provided informed consent prior to the start of data collection.

Source(s) of support: This study had no funding. RZP is a fellowship recipient from the National Council for Scientific and Technological Development - CNPq.

Acknowledgements: We would like to thank the Diretoria de Educação a Distância e Educação Digital (DEDD), a distance learning support centre at the Universidade Federal de Minas Gerais, for assisting the authors in developing the e-learning program and for hosting the program in their server.

Competing interests: Nil.

Provenance: Not invited. Peer reviewed.

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References

1. Carregaro RL, da Silva EN, van Tulder M. Direct healthcare costs of spinal disorders in Brazil. *Int J Public Health*. 2019;64:965–974. https://doi.org/10.1007/s00038-019-01211-6
2. Hoy D, Bain C, Williams G, March L, Brooks P, Blyth F, et al. A systematic review of the global prevalence of low back pain. *Arthritis Rheum*. 2012;64:2028–2037. https://doi.org/10.1002/art.34347
3. GBDLBP Collaborators. Global, regional, and national burden of low back pain, 1990-2020, its attributable risk factors, and projections to 2050: a systematic analysis of the Global Burden of Disease Study 2021. *Lancet Rheumatol*. 2023;5:e316–e329. https://doi.org/10.1016/S2665-9913(23)00098-X
4. George SZ, Fritz JM, Silfies SP, Schneider MJ, Beneciuk JM, Lentz TA, et al. Interventions for the management of acute and chronic low back pain: Revision 2021. *J Orthop Sports Phys Ther*. 2021;51:CPG1–CPG60. https://doi.org/10.2519/jospt.2021.0304
5. Oliveira CB, Maher CG, Pinto RZ, Traeger AC, Lin CW, Chenot JF, et al. Clinical practice guidelines for the management of non-specific low back pain in primary care: an updated overview. *Eur Spine J*. 2018;27:2791–2803. https://doi.org/10.1007/s00586-018-5673-2
6. Caneiro JP, O'Sullivan P, Smith A, Ovrebekk IR, Tozer L, Williams M, et al. Physiotherapists implicitly evaluate bending and lifting with a round back as dangerous. *Musculoskelet Sci Pract*. 2019;39:107–114. https://doi.org/10.1016/j.msksp.2018.12.002
7. Gonzalez-Urzelai V, Palacio-Elua L, Lopez-de-Munain J. Routine primary care management of acute low back pain: adherence to clinical guidelines. *Eur Spine J*. 2003;12:589–594. https://doi.org/10.1007/s00586-003-0567-2
8. Little P, Smith L, Cantrell T, Chapman J, Langridge J, Pickering R. General practitioners' management of acute back pain: a survey of reported practice compared with clinical guidelines. *BMJ*. 1996;312(7029):485–488. https://doi.org/10.1136/bmj.312.7029.485
9. Zadro JR, Ferreira G. Has physical therapists' management of musculoskeletal conditions improved over time? *Braz J Phys Ther*. 2020;24:458–462. https://doi.org/10.1016/j.bjpt.2020.04.002
10. Saes MD, Saes-Silva E, Duro SMS, Neves RG. Inequalities in the management of back pain care in Brazil - National Health Survey, 2019. *Cienc Saude Coletiva*. 2023;28:437–446. https://doi.org/10.1590/1413-81232023282.11792022
11. Zadro JR, O'Keeffe M, Allison JL, Lembke KA, Forbes JL, Maher CG. Effectiveness of implementation strategies to improve adherence of physical therapist treatment choices to clinical practice guidelines for musculoskeletal conditions: systematic review. *Phys Ther*. 2020;100:1516–1541. https://doi.org/10.1093/ptj/pzaa101
12. Amorin-Woods LG, Beck RW, Parkin-Smith GF, Lougheed J, Bremner AP. Adherence to clinical practice guidelines among three primary contact professions: a best evidence synthesis of the literature for the management of acute and subacute low back pain. *J Can Chiropr Assoc*. 2014;58:220–237.
13. da Silva TM, Costa Lda C, Garcia AN, Costa LO. What do physical therapists think about evidence-based practice? A systematic review. *Man Ther*. 2015;20:388–401. https://doi.org/10.1016/j.math.2014.10.009
14. Paci M, Faedda G, Ugolini A, Pellicciari L. Barriers to evidence-based practice implementation in physiotherapy: a systematic review and meta-analysis. *Int J Qual Health Care*. 2021;33. https://doi.org/10.1093/intqhc/mzab093
15. Diniz LM, Oliveira CB, Machado GC, Maher CG, Verhagen AP, Fernandes DA, et al. Effectiveness of brief patient information materials for promoting correct beliefs about imaging and inevitable consequences of low back pain: A randomised controlled trial. *Clin Rehabil*. 2022;36:527–537. https://doi.org/10.1177/02692155211065974
16. Moe-Byrne T, Evans E, Benhebil N, Knapp P. The effectiveness of video animations as information tools for patients and the general public: A systematic review. *Front Digit Health*. 2022;4:1010779. https://doi.org/10.3389/fdgth.2022.1010779
17. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)–a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform*. 2009;42:377–381. https://doi.org/10.1016/j.jbi.2008.08.010
18. Fernandes DAM, Freire APCF, Santos JM, Lemes IR, Diniz LM, Franco MR, et al. The Modified Back Beliefs Questionnaire as a tool to screen for incorrect beliefs regarding back pain: Cross-cultural adaptation and measurement properties. *Int J Osteopath Med*. 2022;44:9–15. https://doi.org/10.1016/j.ijosm.2022.04.001
19. Abdel Shaheed C, Graves J, Maher C. The effects of a brief educational intervention on medical students' knowledge, attitudes and beliefs towards low back pain. *Scand J Pain*. 2017;16:101–104. https://doi.org/10.1016/j.sjpain.2017.04.002
20. Darlow B, Perry M, Mathieson F, Stanley J, Melloh M, Marsh R, et al. The development and exploratory analysis of the Back Pain Attitudes Questionnaire (Back-PAQ). *BMJ Open*. 2014;4:e005251. https://doi.org/10.1136/bmjopen-2014-005251
21. Krug RC, Caneiro JP, Ribeiro DC, Darlow B, Silva MF, Loss JF. Back pain attitudes questionnaire: Cross-cultural adaptation to Brazilian-Portuguese and measurement properties. *Braz J Phys Ther*. 2021;25:271–280. https://doi.org/10.1016/j.bjpt.2020.07.001
22. Jenkins HJ, Hancock MJ, Maher CG, French SD, Magnussen JS. Understanding patient beliefs regarding the use of imaging in the management of low back pain. *Eur J Pain*. 2016;20:573–580. https://doi.org/10.1002/ejp.764
23. Abdel Shaheed C, Maher CG, Mak W, Williams KA, McLachlan AJ. The effects of educational interventions on pharmacists' knowledge, attitudes and beliefs towards low back pain. *Int J Clin Pharm*. 2015;37:616–625. https://doi.org/10.1007/s11096-015-0112-5
24. Hossain MS, Shofiqul Islam M, Glinsky JV, Lowe R, Lowe T, Harvey LA. A massive open online course (MOOC) can be used to teach physiotherapy students about spinal cord injuries: a randomised trial. *J Physiother*. 2015;61:21–27. https://doi.org/10.1016/j.jphys.2014.09.008
25. Munneke W, Demoulin C, Roussel N, Leysen M, Van Wilgen CP, Pitance L, et al. Comparing physical therapy students' attitudes and beliefs regarding chronic low back pain and knee osteoarthritis: an international multi-institutional comparison between 2013 and 2020 academic years. *Braz J Phys Ther*. 2024;28:100592. https://doi.org/10.1016/j.bjpt.2024.100592
26. Jenkins HJ, Brown BT, O'Keeffe M, Moloney N, Maher CG, Hancock M. Development of low back pain curriculum content standards for entry-level clinical training. *BMC Med Educ*. 2024;24:136. https://doi.org/10.1186/s12909-024-05086-x
27. Draper-Rodi J, Vogel S, Bishop A. Effects of an e-learning programme on osteopaths' back pain attitudes: a mixed methods feasibility study. *Pilot Feasibility Stud*. 2021;7:174. https://doi.org/10.1186/s40814-021-00901-4
28. Stander J, Grimmer K, Brink Y. Tailored training for physiotherapists on the use of clinical practice guidelines: A mixed methods study. *Physiother Res Int*. 2021;26:e2174. https://doi.org/10.1002/pri.1883
29. Maia LB, Silva JP, Souza MB, Henschke N, Oliveira VC. Popular videos related to low back pain on YouTube do not reflect current clinical guidelines: a cross-sectional study. *Braz J Phys Ther*. 2021;25:803–810. https://doi.org/10.1016/j.bjpt.2021.06.009
30. Wageck B, Noal IS, Guterres BD, Adami SL, Bordin D, Fanfa M, et al. Keep posting and following social media profiles about physical therapy, but be aware! A cross-sectional study of social media posts on Instagram and Twitter. *Braz J Phys Ther*. 2023;27:100484. https://doi.org/10.1016/j.bjpt.2023.100484