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## MASTERCLASS

### Using research to guide practice: The Physiotherapy Evidence Database (PEDro)



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#### Abstract

**Background:** The Physiotherapy Evidence Database (PEDro) is a free, preeminent, global resource to support evidence-based physical therapy. PEDro provides rapid access to randomized controlled trials, systematic reviews, and clinical practice guidelines evaluating physical therapy interventions.

**Methods:** This paper describes the PEDro scale, PEDro contents, who uses PEDro, searching, browsing the latest content, and developing skills in evidence-based physical therapy. Strategies specifically developed to break down barriers for Portuguese-speaking physical therapists are emphasized.

**Results:** All trials indexed in PEDro are assessed for methodological quality using the 10-point PEDro scale. These ratings are used to rank search results. In August 2019 PEDro indexed 44,309 articles: 34,619 trials, 9004 reviews, and 686 guidelines. The number of trials is predicted to double by 2025. PEDro users come from 214 countries. Physical therapists in Brazil are the largest users (23% of all searches). Physical therapists are encouraged to use the PEDro advanced search page to find answers for their clinical questions. PEDro's 'Evidence in your inbox' allows physical therapists to browse the latest content. To assist users develop skills in evidence-based physical therapy, PEDro includes tutorials and a series of 'how to' videos. PEDro web-site is fully available in Portuguese and English.

**Conclusion:** PEDro facilitates the use of high-quality clinical research by physical therapy clinicians, educators, students, and researchers. In 2019 PEDro celebrated its twentieth anniversary. Some enhancements to mark this milestone include launching a new database called DiTA (Diagnostic Test Accuracy) that focuses on the accuracy of diagnostic tests used by physical therapists.

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## Introduction

Evidence-based practice is the integration of clinical expertise, patient values, and the best research into the decision-making process for patient care. David Sackett—one of the founders of evidence-based practice—defined it as “the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research”.<sup>1</sup> The goal of evidence-based practice is the integration of (1) clinical expertise, (2) scientific evidence, and (3) patient values in providing the best care for patients, reflecting the interests, values, needs, and choices of our patients. Definitions of evidence-based practice have been refined over the years and Herbert and colleagues provided further guidance for using these principles in evidence-based physical therapy, which is informed by relevant, high-quality clinical research.<sup>2</sup> The practice of evidence-based physical therapy involves integrating the research findings with patient values, circumstances and preferences, practice knowledge of the physical therapist, and the clinical context.<sup>2</sup>

Although the concept of evidence-based physical therapy is well accepted, the implementation of new findings into daily practice is not an easy task and presents many challenges.<sup>3,4</sup> First, access to high-quality clinical research may be a barrier for clinicians, who may not know where to find the latest available research. Second, judging the quality of scientific findings is complex and requires critical appraisal of published research. Third, even where clear indications of treatment effects exist, implementing evidence-based physical therapy can be difficult, especially if the results of the research conflicts with current practice.

The Physiotherapy Evidence Database (PEDro) was launched in 1999 to help overcome these barriers. Subsequent developments mean that now the PEDro Partnership offers a range of services to support physical therapists seeking to implement evidence-based physical therapy. PEDro provides physical therapists and others with rapid access to abstracts, bibliographic details, and links to full text for research that uses the best methods to evaluate treatment efficacy (that is, articles reporting randomized controlled trials, systematic reviews, and evidence-based clinical practice guidelines that evaluate the effects of physical therapy intervention). All trials indexed on the database are pre-appraised using the PEDro scale, so that users can quickly find trials that are more likely to be valid and contain sufficient data to guide practice. Users can browse the latest research in 15 areas of practice using PEDro’s ‘Evidence in your inbox’ feature. The PEDro Partnership conducts lectures and workshops to equip users with the skills to critically appraise clinical research, and facilitates the implementation of effective healthcare by working with individuals and groups on implementation projects. The PEDro web-site is available in multiple languages – including Portuguese – to support physical therapists in implementing evidence-based physical therapy through their native language.

The aims of this paper are to describe: (a) the PEDro scale, (b) the contents of PEDro, (c) who uses PEDro, (d) how to search PEDro (simple and advanced search

interfaces), (e) how to browse the latest content, and (f) how to develop skills in evidence-based physical therapy. When considering each aim, we emphasize strategies specifically developed to break down barriers for Portuguese-speaking physical therapists.

## A. PEDro scale

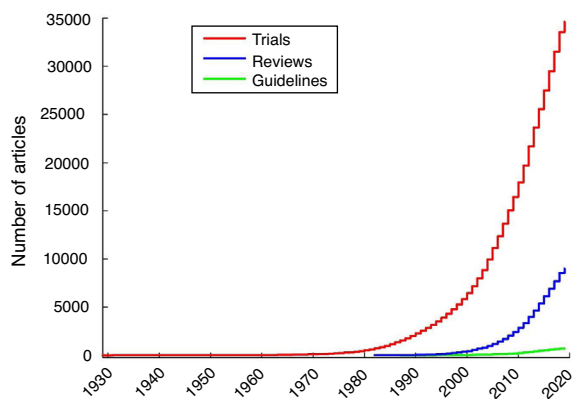
To assist with the interpretation of results of research, all trials indexed in PEDro are assessed for methodological quality. Trials are ranked by quality criteria so users can have rapid access to the most valid trials. The PEDro scale is used to assess the methodological quality of trials (Appendix 1) and it is comprised of 11 items. The first item relates to external validity. The remaining 10 items are used to calculate the final score, which ranges from 0 to 10. The purpose of the PEDro score is to help users identify trials that have good internal validity (items 2–9) and that report enough data to make their results interpretable (items 10–11). The total PEDro score as well as the score for each item is available for every trial indexed in PEDro. This unique feature is crucial for facilitating the use of high-quality clinical research to inform clinical practice, helping users to overcome the barrier of lack of time and skills in critical appraisal. Systematic reviews and clinical practice guidelines are not rated.

Several studies have demonstrated the reliability and validity of the PEDro scale.<sup>5–8</sup> The PEDro scale has been translated and cross-culturally adapted into Brazilian Portuguese following best practice guidelines, so that clinicians who are not proficient in English can also use the scale (Appendix 2). The Portuguese version has acceptably high reliability, similar to the original English version.<sup>9</sup>

## B. PEDro content

PEDro indexes articles that report randomized controlled trials that investigate the effects of physical therapy interventions, and systematic reviews and evidence-based clinical practice guidelines that are based around such trials. All articles that are indexed in PEDro must be peer-reviewed and published as full-text manuscripts. PEDro indexes any articles that meet these criteria, with no restriction by language, journal of publication, or year of publication. For each indexed article, PEDro archives the bibliographic details, the abstract, and links to full-text versions of the article that are available elsewhere online. The specific criteria for trials, reviews, and guidelines to be included in PEDro can be found in Appendix 3.

The articles indexed in PEDro are identified via comprehensive search methods, including automated optimized searches conducted in bibliographic databases (Medline, Embase, CINAHL, PsycINFO, AMED, Cochrane Database of Systematic Reviews, Cochrane CENTRAL Register of Controlled Trials) as well as web-sites of clinical practice guidelines (e.g., <https://www.nice.org.uk/guidance>, <https://www.sign.ac.uk/our-guidelines.html>). Citation tracking is also performed in systematic reviews included in the PEDro database. Therefore, users only need to access a single database to search for answers for questions about the effects of physical therapy interventions.



**Fig. 1** Cumulative number of articles reporting randomized controlled trials, systematic reviews, and evidence-based clinical practice guidelines indexed in PEDro each year.

PEDro is the most comprehensive database of trials, reviews, and guidelines in physical therapy. We have conducted an analysis of the contents of PEDro and extracted data available up to August 2019. There was a total of 44,309 articles indexed in PEDro, including 34,619 randomized controlled trials (78%), 9004 systematic reviews (20%), and 686 clinical practice guidelines (2%). Fig. 1 shows the cumulative number of trials, reviews, and guidelines available each year.

The oldest trial indexed in PEDro was published in 1929. Since then, there has been exponential growth of the number of trials in physical therapy, with 560 trials published in 1999 (the year PEDro was launched) and 2104 in 2018. We used an exponential growth curve to fit the data, resulting in a very good fit (number of trials =  $e^{0.12 \times \text{years since 1929}}$ ;  $r^2 = 0.97$ ). The number of articles reporting trials is doubling about every 6 years. Based on this modelling we estimate that PEDro could contain 70,000 trials in 2025.

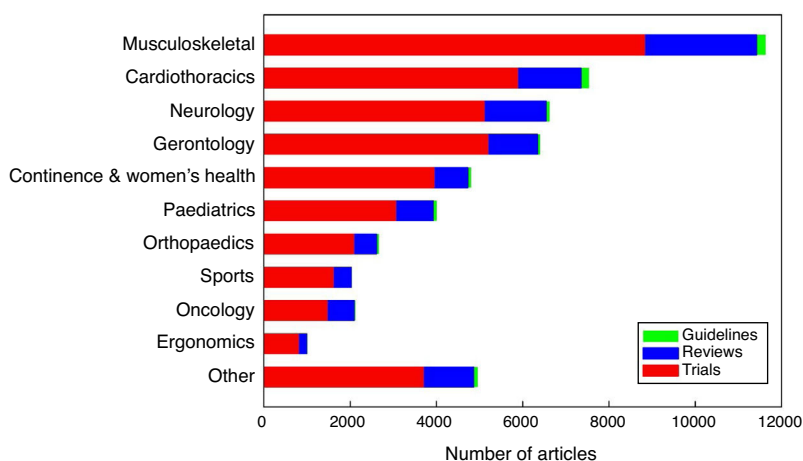
The first archived systematic review and clinical practice guideline were published in 1982 and 1987, respectively. The number of systematic reviews and clinical practice guidelines has increased rapidly, but at a slower rate than for

trials. The number of eligible reviews that are published annually has increased from 68 in 1999 to 858 in 2018. The data are similar for practice guidelines, increasing from 3 in 2008 (when guidelines were first indexed in PEDro) to 46 in 2018. Like for trials, exponential growth curves fit these data well: number of reviews =  $e^{0.25 \times \text{years since 1982}}$  ( $r^2 = 0.85$ ); number of guidelines =  $e^{0.21 \times \text{years since 1987}}$  ( $r^2 = 0.90$ ). The number of articles reporting systematic reviews and clinical practice guidelines is doubling about every 3 years. Based on this modelling we estimate that PEDro could contain 36,000 reviews and 2800 guidelines in 2025.

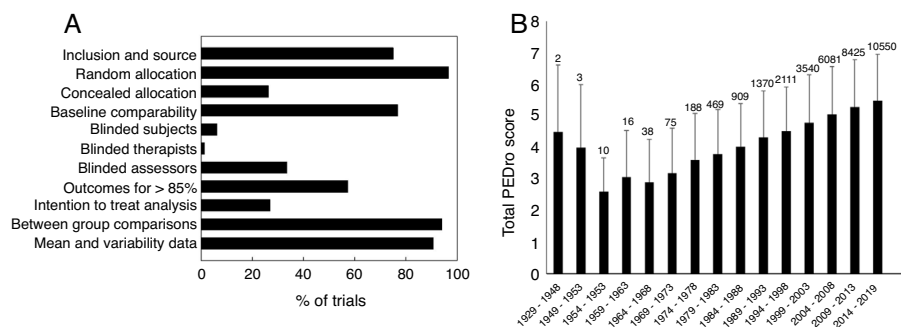
Articles indexed in PEDro were published in 30 languages. The vast majority of articles were published in English (90%), followed by Chinese (5%) and German (1%). In August 2019, 219 articles in Portuguese (130 trials and 89 systematic reviews) were indexed in PEDro.

The articles indexed in PEDro cover all areas of clinical physical therapy practice and are categorised into 10 subdisciplines (Fig. 2). Each article can be coded for up to three subdisciplines of physical therapy. Articles are coded as "other" when it is not possible to code it using the available subdisciplines. Since PEDro was launched, one subdiscipline (oncology) was added in 2002 in response to the growing body of research about physical therapy interventions for this clinical population. The largest proportion of articles indexed in PEDro are in the musculoskeletal subdiscipline, followed by cardiothoracics (Fig. 2).

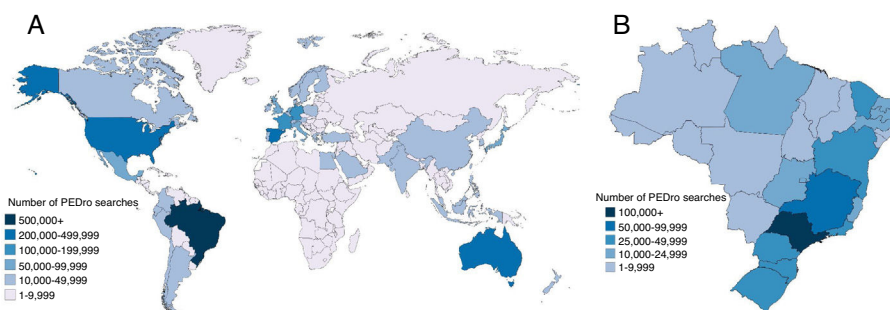
Each trial in the PEDro database is appraised for methodological quality by two independent raters using the PEDro scale. The percentage of trials indexed in PEDro fulfilling each item of the PEDro scale is shown in Fig. 3A. Most trials employ random allocation (97%), report between-group comparisons (94%), and provide point estimates and measures of variability of data (91%). Trials infrequently report: blinding of therapists (1%) or subjects (6%); concealed allocation (26%); and, intention to treat analysis (27%). The mean PEDro score in August 2019 was 5.1 out of 10 (standard deviation, 1.5). Approximately one third of trials (37%) had a PEDro score equal to or greater than 6, and therefore are considered to be of moderate to high quality. Overall the



**Fig. 2** Number of articles reporting randomized controlled trials, systematic reviews, and evidence-based clinical practice guidelines according to the subdisciplines of physical therapy. Note: as each article can be classified for more than one subdiscipline, the total number of articles in this graph does not match the total number of articles in PEDro.



**Fig. 3** A Percentage of articles reporting randomized controlled trials indexed in PEDro that satisfy each item of the PEDro scale. B. Total PEDro score (mean and standard deviation) of articles reporting randomized controlled trials indexed in PEDro since 1929, displayed in 5-year intervals (except for the first and last intervals, which are 20 and 6 years, respectively). The number of trials for each period is indicated at the top of each bar. Note: this graph is based on ratings for 33,787 trials with complete data. The remaining 832 trials indexed in PEDro are in-process, so have not been rated using the PEDro scale yet.



**Fig. 4** PEDro searches across the world (A) and in Brazil (B) for the year between 1 July 2018 and 30 June 2019. Darker colour indicates greater number of PEDro searches.

quality of the trials in physical therapy has increased since 1929 (Fig. 3B).

### C. Description of PEDro users

Over the 12 months between 1 July 2018 and 30 June 2019 the PEDro database was widely used, with users from 214 countries (Fig. 4A). In the period investigated, 2,890,630 searches were performed, meaning that 5 new searches were initiated every minute. Brazil was the leading user of PEDro, accounting for nearly one quarter of the searches (675,533, 23%). The other countries with high usage were United States of America (9%), Spain (8%), Australia (7%), and France (5%).

PEDro was used across all states in Brazil, with the highest usage rates concentrated in the southeast area (Fig. 4B). The states that mostly commonly used PEDro were: São Paulo (29%), Minas Gerais (15%), and Bahia, Ceará, and Rio de Janeiro (all 6%). These five states together accounted for 62% of PEDro usage in Brazil.

### D. How to search PEDro

Because PEDro only indexes trials, reviews, and guidelines related to physical therapy, it can be used to search efficiently for high-quality research to answer clinical questions about the effects of physical therapy interventions.

Users can search PEDro with either of two interfaces. Simple searches can be conducted using one interface (<http://search.pedro.org.au/search>), which consists of one field where users can enter free text. The database then returns all articles for which all of the entered text is included in the article's title or abstract. More advanced searches can be conducted using the other interface (<http://search.pedro.org.au/advanced-search>). Here, search criteria can be entered into any of 13 optional search fields. Six of the fields (*Therapy*, *Problem*, *Body Part*, *Subdiscipline*, *Topic*, and *Method*) have pull-down menus with options that correspond to the coding of articles in the database. The remaining fields allow free text to be entered: *Title & Abstract*, *Title Only*, *Author/Association*, *Source*, *Published Since*, *New Records Added Since*, and *Score of at least*. The interfaces are shown in Figs. 5A and 5B. As a general guide, physical therapists should use the advanced search interface as this encourages greater precision when entering search terms to answer clinical questions.<sup>10,11</sup>

While both interfaces are intuitive, the searches entered by users have been analysed and some common errors were identified.<sup>10</sup> For example, Boolean operators and parentheses do not function within any individual search fields in the advanced or simple search interfaces. Also, bibliographic details of articles are entered into PEDro using only American Standard Code for Information Interchange (ASCII) characters. Therefore, users who are searching with a name

Fig. 5 The simple (panel A) and advanced (panel B) search interfaces for PEDro.

such as “Gonçalves” in the *Author/Association* field or the term “esclerose múltipla” in the *Title Only* field would have to enter “Goncalves” or “esclerose multipla” to conduct a valid search. Therefore, automated alert messages were added to the interface to notify readers when they try to enter erroneous text in one of the free-text search fields. These alerts have led to a small reduction in the number of erroneous searches.<sup>11</sup>

When a search is conducted, the results of the search are presented in a particular order: guidelines are shown first (sorted by year), followed by reviews (with reviews published in the Cochrane Database of Systematic Reviews appearing before reviews published in other journals, both sorted by year), and then trials (from highest quality to lowest quality). This appears to encourage users to click on more synthesized and higher-quality research within the search results.<sup>12</sup>

Searching PEDro is free for anyone who has access to the internet. Almost all articles in PEDro show the abstract and about half of the articles in PEDro also have links to free full text online, so even users who do not have access to a library of journals will still find it fruitful.

### E. How to browse the latest content (‘Evidence in your inbox’)

A service was added to PEDro in 2015 to assist users who would like to regularly browse the latest content. This service is called ‘Evidence in your inbox’. Users can sign up to receive free monthly updates via email that detail the most recent additions to PEDro in up to 15 areas of practice. This has been a very popular service, with over 13,600 subscribers in August 2019. Brazil has a high rate of uptake, accounting for 35% of subscribers. Engagement rates for all areas exceed the industry average for number of opens (up to 29% for ‘cerebral palsy’), and click-throughs (up to 8% for ‘musculoskeletal’). Clinicians, researchers, and educators value the service very highly, using the feeds for journal clubs, to inform practice, and to prepare lectures.

### F. Developing skills in evidence-based physical therapy

Skills in evidence-based physical therapy include being able to ask a clinical question, find relevant clinical research, appraise the quality of the identified research, and integrate the findings into clinical decision making for individual patients. Many features have been implemented within and alongside the original database to assist users to develop these skills.

To facilitate the use of PEDro we have made the web-site and YouTube channel available in 13 languages.<sup>13</sup> Both the web-site and YouTube channel are available in Portuguese, English, Simplified Chinese, Traditional Chinese, French, German, Italian, Japanese, Korean, Spanish, and Tamil. The web-site is also available in Turkish and the YouTube channel in Dutch. Among these, the English-language sections of the web-site had the largest number of pageviews (83%) followed by Portuguese (11%). The most commonly viewed languages in the PEDro YouTube channel were English (59%) and Portuguese (20%). We also provide newsletters, blogs, and social media (Facebook and Twitter) in English and Portuguese language.

PEDro has developed tutorials, including videos, to support physical therapists in developing their searching and appraisal skills. We have published several “How to” videos on the PEDro web-site including: how to ask a clinical question, and how to perform a PEDro simple or advanced search. The videos can be accessed via the PEDro search help pages (<http://www.pedro.org.au/portuguese/search-help/>) and the PEDro YouTube channel (<https://www.youtube.com/c/PhysiotherapyEvidenceDatabasePEDro>; see the Portuguese playlist).

The PEDro scale has been developed for rating the validity of trials through critical appraisal. To facilitate the use of the PEDro scale, we have launched a training program for PEDro raters. It provides a definition and detailed description of each item on the scale, relevant references, answers to frequently asked questions, examples, and practice articles for each item of the PEDro scale. The PEDro

scale training program is currently available in English and Portuguese. The training is online through a 3-month subscription for a small fee (<https://training.pedro.org.au/>).

### Future recommendations and plans

Using high-quality clinical research to inform practice is a professional imperative. This will require deliberate and sustained efforts from individual physical therapists and the organizations and businesses that support physical therapists to practice safely and effectively. Individual physical therapists need to engage in life-long learning to develop their skills in areas like evidence-based physical therapy (including posing questions for clinical uncertainty, searching to identify high-quality clinical research to answer these questions, reading research (including critical appraisal), and implementing changes to their practice). Organizations and businesses can strive to produce, report, and promote the best research to guide practice. There are several ways that this could occur. Educators could ensure that training programs are evidence-based and include strategies for changing practice as new knowledge is developed. Researchers, research funders, ethics committees, and journals could ensure that research to answer important questions is conducted rigorously and clearly communicated (it would be nice not to have to wait until about 2056 for all new physical therapy trials to achieve a total PEDro score of 8/10<sup>14</sup>). Funders of physical therapy services could reward the implementation of evidence-based care. Peak physical therapy groups like the World Confederation for Physical Therapy and its member organizations could promote the best research to their members and support local and global initiatives like PEDro.<sup>15</sup>

PEDro will continue to be developed to facilitate the use of high-quality clinical research by physical therapy clinicians, educators, students, and researchers. In October 2019 PEDro celebrated its twentieth anniversary. Some key enhancements to mark this important achievement include:

- 1 The PEDro web-site and training materials, already available in 13 languages, will be expanded to include Arabic and Ukrainian.
- 2 Ensuring that the content distribution platforms used for PEDro are accessible world-wide (including in countries like China).
- 3 Adding new subspecialty codes (and associated 'Evidence in your inbox' feeds) in response to the evolution of physical therapy practice. Codes that are currently under consideration are for mental health and metabolic conditions (including diabetes and obesity).
- 4 Launching a new database called DiTA (Diagnostic Test Accuracy) that focuses on the accuracy of diagnostic tests used by physical therapists.<sup>16</sup>

PEDro will continue to refine and initiate strategies like 'Evidence in your inbox' to promote the results of

high-quality clinical research that are of high importance to the global physical therapy community. Because PEDro is produced on a not-for-profit basis with support from industry partners, these initiatives will be dependent on attracting sufficient funding.

### Conflict of interest

The authors are all involved in the production of the Physiotherapy Evidence Database (PEDro). MRE and AMM sit on the Steering Committee for the PEDro Partnership. PVDW is on the Advisory Panel for the PEDro Partnership. MBP is a member of the PEDro Education and Training Subcommittee. There are no other conflicts of interest to declare.

### Acknowledgement

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**Appendix 1 PEDro scale. Detailed notes on using the PEDro scale can be found on the PEDro web-site (<https://www.pedro.org.au/english/downloads/pedro-scale>)**

- 
1. eligibility criteria were specified
  2. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)
  3. allocation was concealed
  4. the groups were similar at baseline regarding the most important prognostic indicators
  5. there was blinding of all subjects
  6. there was blinding of all therapists who administered the therapy
  7. there was blinding of all assessors who measured at least one key outcome
  8. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups
  9. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by "intention to treat"
  10. the results of between-group statistical comparisons are reported for at least one key outcome
  11. the study provides both point measures and measures of variability for at least one key outcome
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**Appendix 2 PEDro scale – Portuguese (Brazil) version. Detailed notes on using the PEDro scale Brazilian Portuguese version can be found on the PEDro web-site (<https://www.pedro.org.au/portuguese/downloads/pedro-scale>)**

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- [1.] Os critérios de elegibilidade foram especificados
2. Os sujeitos foram aleatoriamente distribuídos por grupos (num estudo cruzado, os sujeitos foram colocados em grupos de forma aleatória de acordo com o tratamento recebido)
  3. A alocação dos sujeitos foi secreta
  4. Inicialmente, os grupos eram semelhantes no que diz respeito aos indicadores de prognóstico mais importantes
  5. Todos os sujeitos participaram de forma cega no estudo
  6. Todos os terapeutas que administraram a terapia fizeram-no de forma cega
  7. Todos os avaliadores que mediram pelo menos um resultado-chave, fizeram-no de forma cega
  8. Mensurações de pelo menos um resultado-chave foram obtidas em mais de 85% dos sujeitos inicialmente distribuídos pelos grupos
  9. Todos os sujeitos a partir dos quais se apresentaram mensurações de resultados receberam o tratamento ou a condição de controle conforme a alocação ou, quando não foi esse o caso, fez-se a análise dos dados para pelo menos um dos resultados-chave por “intenção de tratamento”
  10. Os resultados das comparações estatísticas inter-grupos foram descritos para pelo menos um resultado-chave
  11. O estudo apresenta tanto medidas de precisão como medidas de variabilidade para pelo menos um resultado-chave
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**Appendix 3 Summary of the eligibility criteria for inclusion in PEDro. Detailed information on eligibility can be found on PEDro web-site (<https://www.pedro.org.au/english/downloads/criteria>)**

Randomized controlled trials

- 1 Involve comparison of at least two interventions;
  - 2 At least one of the interventions is part of physical therapy practice;
  - 3 Interventions are applied to human subjects who are representative of those to whom the intervention might be applied in the course of physical therapy;
  - 4 Employ a random allocation or intended-to-be-random allocation of subjects to interventions; and
  - 5 Published as a full paper in a peer-reviewed journal.
- Systematic reviews
- 1 Contain a methods section which describes the search strategy and inclusion criteria;
  - 2 Include at least one trial, review, or guideline (or explicitly search for but not find a trial, review, or guideline) that satisfies the criteria for inclusion in PEDro;

- 3 Published as a full paper in a peer-reviewed journal. Clinical practice guidelines
- 1 Produced under the auspices of a health professional association or society, public or private organisation, health care organisation or plan, or government agency;
- 2 Publicly available;
- 3 Systematic literature search and review of existing scientific evidence published in peer-reviewed journals was performed during the guideline development OR the guidelines were based on a systematic review published in the four years preceding publication of the guideline;
- 4 Contains systematically developed statements that include recommendations, strategies, or information to guide decisions about appropriate health care;
- 5 At least one recommendation concerns at least one intervention that is currently part of physical therapy practice;
- 6 Physical therapy recommendations are based on at least one randomized controlled trial or systematic review related to physical therapy.

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