ConheceDOR: the development of a board game for modern pain education for patients with musculoskeletal pain

ConheceDOR: desenvolvimento de um jogo de tabuleiro para educação moderna em dor para pessoas com dor musculoesquelética

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ABSTRACT

BACKGROUND AND OBJECTIVES: Chronic pain is one of the main challenges for health systems. Pain education and self-motivated strategies have great potential in the treatment of people with chronic pain, especially by modifying beliefs and behavior. The development of board games for educational purposes can contribute to the learning of pain concepts and behavioral strategies. The objective of this study was to develop a board game (ConheceDor) to be used as an intervention tool for pain education.

CONTENTS: The systematic review for the development of the game *ConheceDor*, considered the following search strategy: "chronic pain", "musculoskeletal pain", "health education", "patient education", "neuroscience education", "pain education", "therapeutic neuroscience education". The primary outcomes considered were pain intensity and disability. Fifteen studies were included, with a total of 1,486 participants. Six studies reported reduction on pain of at least 10%, and two studies reported an improvement of at least 30% on disability. For the development of the game, we elaborated the layout of the board, the rules and other components (dice, cards, and pins). The cards of the game included the contents commonly used in the randomized controlled trials: negative thoughts, pain neurophysiology, stress management, and relaxation, coping and exercises.

CONCLUSION: The development of the present board game was based on the critical appraisal of the content of educational strategies present in the literature. The board game can be a potent resource to be applied in clinical practice in people with musculoskeletal pain.

Keywords: Chronic pain, Experimental games, Health education, Neuroscience-based education.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dor crônica é um dos principais desafios para os sistemas de saúde. As estratégias comportamentais e a educação em dor apresentam grande potencial no tratamento de pessoas com dor crônica, especialmente pela modificação de crenças e do comportamento. Os jogos de tabuleiro podem ser uma estratégia educativa que contribui para a aprendizagem dos conceitos sobre dor e estratégias comportamentais. O objetivo deste estudo foi desenvolver um jogo de tabuleiro (ConheceDor) como ferramenta de intervenção para educação em dor.

CONTEÚDO: A revisão sistemática para o desenvolvimento do jogo *ConheceDor*, considerou a estratégia de busca com os descritores "chronic pain", "musculoskeletal pain", "health education", "patient education", "neuroscience education", "pain education", "therapeutic neuroscience education". Os desfechos primários considerados foram a intensidade da dor e a incapacidade. Foram incluídos 15 estudos com um total de 1.486 participantes. Seis estudos apresentaram redução da dor de pelo menos 10% e dois estudos atingiram uma melhora de pelo menos 30% na incapacidade. Para o desenvolvimento do jogo foram elaborados o layout do tabuleiro, as regras e os demais componentes (dados, cartas, pinos). As cartas do ConheceDor incluíram os temas mais utilizados nos estudos identificados que foram: pensamentos negativos, neurofisiologia da dor, manuseio do estresse e relaxamento, enfrentamento e exercícios físicos.

CONCLUSÃO: A criação de um jogo de tabuleiro considerou uma análise crítica da literatura dos conteúdos das estratégias educativas presentes nos ensaios clínicos. O desenvolvimento dessa intervenção pode ser um recurso para ser aplicado na prática clínica em pessoas com dor musculoesquelética.

Descritores: Dor crônica, Educação com base em neurociência, Educação em saúde, Jogos experimentais.

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INTRODUCTION

The health conditions that are characterized by the presence of pain can lead to disability and high costs to the individual and

society. Chronic musculoskeletal pain, especially cervical and low back pain are among the main health conditions associated with disability[1]. Nowadays, cognitive-emotional and behavioral factors, in addition to the physical factors, are considered as contributing to the disability observed in people with chronic pain[2-4].

Pain may be associated with the presence of emotional changes such as catastrophic thoughts, anxiety, fear, kinesiophobia, maladaptive behaviors, and depression[5-8]. The literature highlights pain education (PE) and behavioral interventions to intervene in this components[9,10]. Recently, a systematic review evaluated the efficacy of pain neuroscience education in patients with chronic musculoskeletal pain and identified that the intervention contributed to the reduction of pain, disability, and catastrophization[11]. Behavioral and cognitive interventions help in the deconstruction of negative thinking patterns, beliefs, emotional states, and maladaptive behaviors, with the main objectives of reducing symptom-related distress, improving functionality, assisting in changing adaptive patterns, and teaching techniques for the self-management of pain[12].

Educational games can contribute to the learning process since they favor the interaction of the participants and the assimilation of concepts in a playful way[13,14]. Considering that the development of individuals is related to the learning process acquired through the socio-cultural interaction[13], the use of games as a teaching-learning proposal allows the content to be presented and the concepts constructed during the course of the game[14]. Educational games can be relevant tools used in the PE process to teach and learn the contents as well as for the modification of behaviors through the construction of knowledge.

The objective of this study was to develop a board game (Knowing Pain, in Portuguese ConheceDor) to serve as a tool to promote the knowledge about the pain concepts and the motivational strategies for people with chronic musculoskeletal pain.

CONTENTS

A systematic review of the literature of intervention studies using PE or behavioral strategies was carried out to develop the board game. The protocol defined for this study followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA). The question of the review was: "what are the contents of education and pain relief interventions used in randomized clinical trials that have promoted benefits for pain and disability outcomes in people with chronic musculoskeletal pain"? These contents, identified exclusively in clinical trials, were used to elaborate the domains of the board game *ConheceDor*.

Inclusion and exclusion criteria

The studies considered were randomized controlled trials that investigated the effects of PE based on neuroscience or behavioral, self-management or motivational strategies on pain and disability. The studies should include participants over 18 years of age and with musculoskeletal pain lasting longer than 12 weeks. Interventions could be done in person or at distance (online, telehealth, among others), individually or in a group. In case there has been an intervention with contact with the health professional and the other group having received the intervention at a distance, the in-person intervention was used. The studies should be available for access, and there was no restriction on the language of publication provided that the translation was available. We excluded studies that used as main intervention education based on only biomedical concepts, as well as those that provided an orientation of posture or only orientations based on purely biomechanical concepts. The exclusion of this type of study was because these concepts contribute to the increase of catastrophization, anxiety, and fear related to pain[11]. The control groups could be from usual treatment, waiting list or other educational strategies. Also, PE or behavioral strategies could be associated with other interventions such as exercises, for example. The primary outcomes considered for the study were pain intensity and disability. The secondary outcomes included changes in catastrophizing, kinesiophobia, anxiety, depression, improvement perception, patient satisfaction, and return to work. In addition to these criteria, a minimum score of six on the PEDro scale was adopted for methodological quality.

Search strategy for the identification of the studies

A search was performed on the Pubmed, PEDro, Scopus, and Web of Science databases in February 2018. The search strategy utilized the following descriptors: "chronic pain" OR "musculoskeletal pain" AND "health education" OR "patient education" OR "neuroscience education" OR "pain education" OR "therapeutic neuroscience education" (Annex 1). The search terms were adapted for use with other bibliographic databases in combination with specific database filters for controlled trials, when available.

Selection of studies and data extraction

After the search, the results were imported to the EndNote Web. Considering the eligibility criteria, two researchers independently selected the potentially eligible articles based on the title, abstract and full text. There was no blinding for the journal or authors. The data extraction was performed, and the divergences were resolved by consensus. In the absence of consensus, a third evaluator could be convened. The data extracted included the author (year), clinical condition, population, intervention group, the control group, follow-up, outcomes and content of interventions.

Data analysis

In order to identify the contents used in the educational interventions of the clinical trials included in the present study, the data analysis was performed descriptively. The intragroup difference between baseline and post-intervention measures was considered to attest the modification of the interventions on pain and disability outcomes. The follow-up time was grouped in short (up to 3 months), medium (3 to 6 months) and long (over 6 months), and the largest follow-ups were considered for grouping. The change in outcomes was presented as a percentage. The

reduction of at least 10% in pain intensity and an improvement of at least 30% in disability was considered a significant change. After identifying the studies that reached these values of change, the contents of the interventions were grouped by similarity and presented by their absolute frequencies.

The overall quality of the evidence was evaluated using the PEDro scale which has 11 items and a total score of 10 according to the following criteria: eligibility criteria; random allocation; secret allocation; comparability at the baseline; participants; blind therapist surveyors; suitable *follow-up*; intention-to-treat analysis; comparison between groups; accuracy and variability. The highest score on the PEDro scale indicated better methodological quality.

Board game development

After the identification of the studies, the development of the *ConheceDor* board game began. For this stage, two researchers identified the contents of the interventions used in the studies included in the systematic review and then developed the main elements to visually compose the board that included the layout, the number, and content of the houses and cards, the rules and other components (dice and pins). For the development of the charts of the board domains, the content addressed in at least 50% of the studies was selected.

Description of the studies

The initial search identified a total of 2,907 studies. Of these, 1,945 duplicate studies were excluded. The screening of titles and abstracts identified 44 potential articles and, after a detailed

analysis of the full text of the studies, the final sample for analysis was composed of 15 studies (Figure 1). The main reasons for the exclusion of the articles were: not being a clinical trial, not describing how the educational proposal was performed and presenting a score lower than six on the PEDro scale. The studies that did not meet the inclusion criteria were excluded, that is, access not available (n=3); educational content not described (n=2) or education combined with other intervention (n=1); no evaluation of the outcomes considered for the inclusion (n=1); addressing patients with acute pain or cancer-related pain (n=2); using posture-orientation based content (n=2) and with a PEDro score <6 (n=18).

Characteristics of the articles included

Fifteen studies were included, totaling 1,486 people with chronic musculoskeletal pain. Five studies with people with chronic low back pain[15-19], four studies with musculoskeletal pain of different origins[20-23], two studies with participants with chronic neck pain[24,25], one study with patients with chronic fatigue syndrome[26], one study with fibromyalgia[27], one study with participants with spinal pain or upper back pain[28], one study with patients with chronic knee pain[29].

Among the interventions, seven studies (46.7%) used neuroscience-based PE[15,17,18,22,25,26,29], five studies (33.4%) used PE and behavioral strategies[20,21,23,24,27], one study (6.7%) used only behavioral strategies[19], one study (6.7%) used general health guidelines[28] and one study (6.7%) associated neuroscience-based PE with hypnosis[16]. Table 1 presents the characteristics of the studies included in the systematic review.
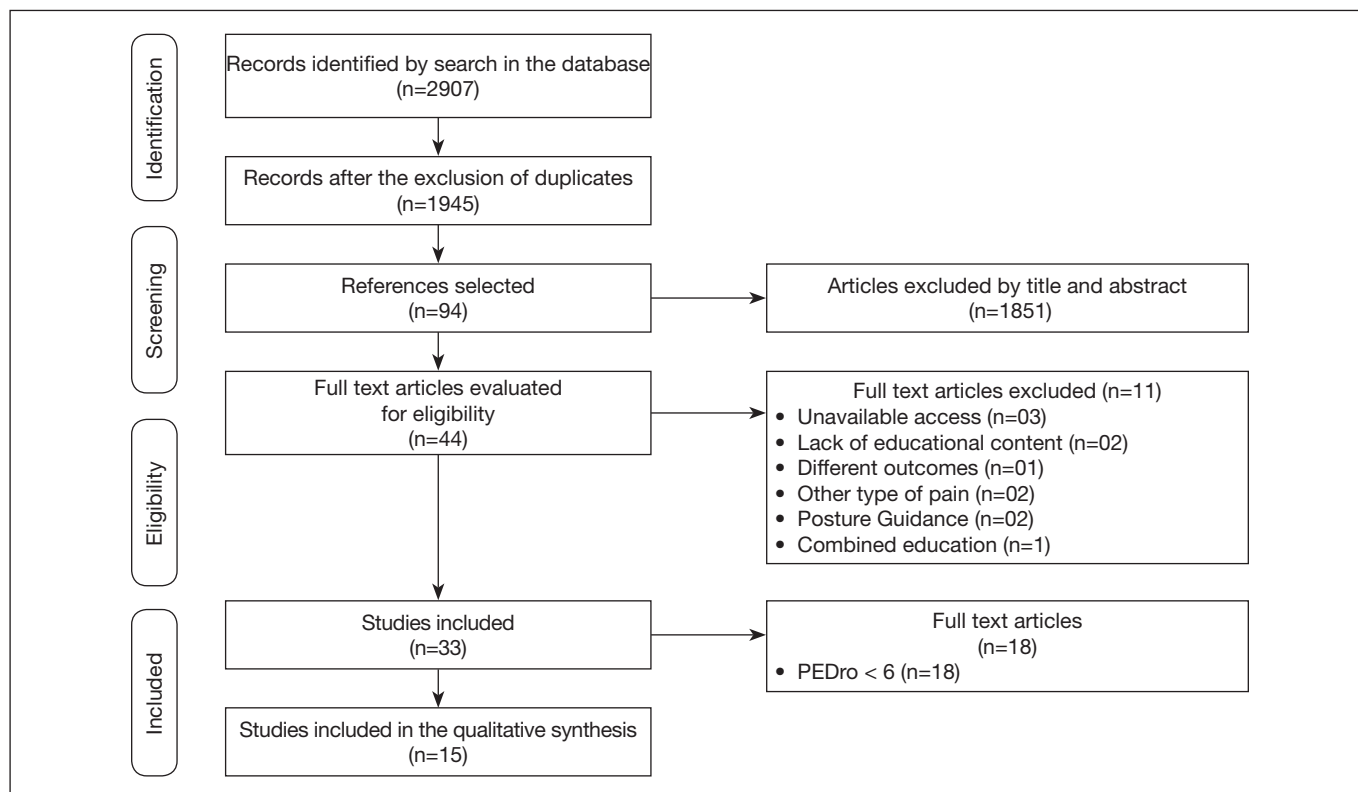

Figure 1. The selection process of the studies for inclusion in the systematic review

Table 1. Summary of the studies included (n=15)

Authors	Clinical condition	Population	Intervention group	Control group	Follow-up	Outcomes
Andersen et al.[28]	Pain in the spine or upper back	n=141 F=78; Age=45.2±0.5 years	Personalized physical activity group = 1.5h of general health guidelines + aerobic and strength exercises for 50min (n=47). Group of self-management=1.5h of general health guidelines + weekly workshop of 2.5h for 6 weeks in groups of 12 to 18 people (n=47).	Reference treatment group = 1.5h of general health guidelines (n=47).	3 months	Intensity of pain with VAS (zero to 100mm); Ability to work (VAS zero to 100mm); TSK.
Bennell et al.[29]	Chronic knee pain	n=148 F=83; Age=61.1±7.5 years	Three internet interventions: educational material on the exercises + educational material on coping + 7 consultations via Skype with a physiotherapist for exercise prescription (n=74).	Two interventions via the internet: educational material on the exercises + educational material on coping (n=74).	3 and 9 months	Mean pain during gait in the previous week (zero to 10); WOMAC and PSC.
Brage et al.[24]	Chronic neck pain	n=20 F=20; Age=41.4±12.2 years	4 sessions of 1.5h on education + 8 sessions of 30min with specific exercises (shoulder girdle and shoulder, balance and aerobic training) (n=10).	4 sessions of 1.5h, covering topics on mechanisms, acceptance, coping strategies and definition of pain goals based on the concepts of pain management and cognitive-behavioral therapy (n=10).	4 and 12 months	Pain (NRS from zero to 10); Neck-related disability (NDI); Perceived Global Effect (GPE).
Carmody et al.[23]	Chronic musculoskeletal pain (low back and neck pain, with and without radiculopathy, arthritis)	n=101 F=3; Age=67.5±9.5 years	Cognitive behavioral therapy by telephone (12 weeks) (n=50)	Telephone education (12 weeks) (n=51)	2, 5, 8 and 12 months	Health-related quality of life (SF-12v2); BDI; PBCL; CSQR; Intensity of pain (pain journal for two weeks); PSC.
Chiauzzi et al.[15]	Chronic low back pain	n=199 F=134; Age=46.1±11.9 years	Online education for low back pain (painACTION-Back Pain) (painACTION-Back Pain) n=104)	Low back pain guide that should be read in 4 weeks (n=105)	1, 3 and 6 months	BPI, ODQ, DASS, PGIC, CPCI, PSC, PSEQ FABQ.
Gallagher, McAuley and Moseley[22]	Chronic musculoskeletal pain	n=79 F=48; Age=43.5±11 years	Booklet on pain education through metaphors (n=40).	Information booklet on pain (n=39).	3 months	PBQ, PSC, NRS 0-10, PSFS.
Lefort et al.[20]	Chronic musculoskeletal pain	n=110 F=82 Age=39.5 years	Psychoeducation program (2 hours per week for 6 weeks) (n=57)	Waiting list (n=53)	6 weeks	SF-36, PRI, SF-MPQ, SF-BDI; SOPA-D, VAS=100mm.
Meeus et al.[26]	Chronic fatigue syndrome	n=48 F=40 Age=40.3±10.4 years	Neuroscience-based pain education (n=24)	Information on self-management seeking the balance between activity and rest to avoid exacerbations and establish realistic goals to increase activity (n=24).	Post-treatment	NPT, PCS, TSK, PCI.

Table 1. Summary of the studies included (n=15)

Authors	Clinical condition	Population	Intervention group	Control group	Follow-up	Outcomes
Moseley, Nicholas and Hodges[18]	Chronic low back pain	n=58 F=33 Age=43.58 years	Neuroscience-based pain education (n=31)	Education on the anatomy of the spine (n=27)	Post-treatment	RMDQ, SOPA-R, PSC.
Nicholas et al.[19]	Chronic pain	n=141 F=96 Age=73.9±6.5 years	Self-management of pain (8 sessions of 2h for 4 weeks) + encouragement to practice exercises at home (n=49) Self-management of pain (8 sessions of 2h for 4 weeks) (n=53)	Waiting list (n=39)	1, 6 and 12 months	NRS, mRMDQ; DASS-21, TSK, PSEQ, PRSS.
Ris et al.[25]	Chronic neck pain	n=200 F=149 Age=45.1 years	Pain education with a focus on the understanding/acceptance of pain and goals setting (4 sessions (1.5h each, once a month) + 8 sessions of exercises (neck muscles, balance, oculomotor training, shoulder girdle (n = 101)	Pain Education with a focus in the understanding/acceptance of pain and goals setting (4 sessions (1.5h each, once a month) (n=99)	4 months	SF-36, NDI, BDI-II, TSK.
Rizzo et al.[16]	Chronic low back pain	n=100 F=80 Age=50±13.5 years	Neuroscience-based pain education (4 sessions; 2 times/week) + hypnosis (2h of self-hypnosis in 2 weeks + book with hypnosis suggestions) (n=50)	Neuroscience-based pain education (4 sessions; 2 times/week) (n=49)	3 months	NRS, RMDQ, PSC, GPE, PSFS.
Ryan et al.[17]	Chronic low back pain	n=38 F=25 Age=45.3±10.7 years	Neuroscience-based pain education + 6 sessions of exercises for 8 weeks (10min warm-up, 20-30min aerobic phase, and 10-15min slowdown) (n=20).	Neuroscience-based pain education (2.5 h reformulation of beliefs and attitudes regarding pain) (n=18)	3 months	NRS, TSK-13, PSEQ.
Thorn et al.[21]	Chronic musculoskeletal pain	n=73 F=65 Age=52.8±13.1 years	Cognitive-Behavioral Therapy + homework (1.5h, once/week, 10 weeks) (n=49)	Education on pain neurophysiology (1.5h, once/week, 10 weeks) (n=34)	6 months	BPI, RMDS, PSC, CES-D, QOLS.
Van Oosterwijck et al.[27]	Fibromyalgia	n=30 F=26 Age=45.8±10.5 years	Neuroscience-based pain education (2 sessions; 30 minutes) (n=15)	Self-management (self-management techniques and handling of daily activities in relation to their symptoms). (2 sessions, 30 minutes) (n=15)	3 months	FIQ), SF-36, PCI, PCS, TSK, PVAQ.

VAS = visual analog scale; PSC = Pain Catastrophizing Scale; WOMAC = Arthritis Self-Efficacy Scale; TSK = Tampa Scale of Kinesiophobia; NDI = Neck Disability Index; GPE = Global Perceived Effect; SF-12v2 = Short Form 12v2 Health Survey; BDI - Beck Depression Inventory; PBCL = Pain Behavior Checklist; CSQR = Coping Strategies Questionnaire Revised; BPI = Brief Pain Inventory; ODQ = Oswestry Disability Questionnaire; DASS = Depression Anxiety Stress Scale; PGIC = Patient Global Impression of Change; CPCI = Chronic Pain Coping Inventory; PSEQ = Pain Self-Efficacy Questionnaire); FABQ = Fear-Avoidance Beliefs Questionnaire; PBQ = Pain Biology Questionnaire; NRS = Numerical Rating Scale; PSFS = Patient-Specific Functional Scale; SF-36 = Medical Outcomes Study Short Form-36; PRI = Pain Rating Index; SF-MPQ = Short Form-McGill Pain Questionnaire; SF-BDI = Short Version - Beck Depression Inventory; SOPA-D = Survey of Pain Attitudes; NPT = Neurophysiology of Pain Test; PCI = Pain Coping Inventory; RMDQ = Roland Morris Disability Questionnaire; SOPA-R = Survey of Pain Attitudes-Revised; mRMDQ = Roland Morris Disability Questionnaire-Modified; DASS-21 = Depression Anxiety Stress Scales; PRSS = Pain Response Self-Statements Scale; BDI-II = Beck Depression Inventory-II; RMDS = Roland-Morris Disability Scale; CES-D = Center for Epidemiological Studies Depression Scale; QOLS = Quality of Life Scale -QOLS; FIQ = Fibromyalgia Impact Questionnaire; SF-36 = Medical Outcomes Short Form 36 Health Status Survey; PVAQ = Pain Vigilance and Awareness Questionnaire.

Methodological quality of the studies included

The risk of bias of the articles included in the present systematic review was independently assessed by two reviewers who used the PEDro scale to analyze the methodological quality (Table 2).

Change in pain and disability

Regarding the primary outcomes (pain intensity and disability), six studies reported pain reduction of at least 10% and two studies achieved at least 30% improvement in disability compared to baseline. The percentages of modification for

pain and disability, considering the *follow-up* time are presented in table 3.

The content of interventions and domains found in the studies

Considering the contents covered in the studies of the systematic review it was possible to observe that the most frequent contents included negative thoughts and behavior (n=5)[15,19,21,23,29], stress management and relaxation techniques (n=5)[15,19,21,23,29], pain neurophysiology (n=4)[16,17,19,23], exercises and return to activity (n=4)[15,16,19,29] and coping strategies (n=3)[15,23,29]. Figure 2 shows

Table 2. Methodological quality of the studies included considering the PEDro scale criteria

Studies	Criteria											Total
	1	2	3	4	5	6	7	8	9	10	11	
Andersen et al.[28]	X	V	X	V	X	X	V	V	V	V	V	7
Bennell et al.[29]	V	V	V	V	X	X	X	V	V	V	V	7
Brage et. al[24]	V	V	V	V	X	X	V	X	V	V	V	7
Carmody et. al.[23]	V	V	X	V	X	X	V	X	V	V	V	6
Chiauzzi et al.[15]	V	V	X	V	X	X	X	V	V	V	V	6
Gallagher, McAuley and Moseley[22]	X	V	V	V	X	X	X	V	X	V	V	6
Lefort et al.[20]	V	V	V	V	X	X	V	V	V	V	V	8
Meeus et al.[26]	V	V	V	V	X	X	V	V	X	V	V	7
Moseley, Nicholas and Hodges[18]	V	V	X	V	X	X	V	V	X	V	V	7
Nicholas et al.[19]	V	V	X	V	X	X	V	X	V	V	V	6
Ris et al.[25]	X	V	V	V	X	X	X	X	V	V	V	6
Rizzo et al.[16]	V	V	V	V	X	X	V	V	V	V	V	8
Ryan et al.[17]	X	V	V	V	X	X	V	V	X	V	V	7
Thorn et al.[21]	V	V	V	V	X	X	X	X	V	V	V	6
Van Oosterwijck et al.[27]	V	V	X	V	V	X	V	V	V	V	V	8

1 = Eligibility Criteria; 2 = Random allocation; 3 = Secret allocation; 4 = Comparability at baseline; 5 = Blinding of participants; 6 = Blinding of therapists; 7 = Blinding of evaluators; 8 = Suitable follow-up; 9 = Analysis by intention-to-treat; 10 = Comparison between groups; 11 = Measurement of accuracy and variability. X = absence; V = presence.

Table 3. Percentage of change from baseline on pain and disability outcomes considering the follow-up periods of the studies included

Authors	Change from baseline (%)					
	Short (≤3 months)		Medium (3-6 months)		Long (>6 months)	
	Pain	Disability	Pain	Disability	Pain	Disability
Andersen et al.[28]	- 6.3	-	-	-	-	-
Bennell et al.[29]	**-17.4**	15.0	-	-	**-24.1**	20.9
Brage et. al[24]	-	-	-	-	2.0	12.2
Carmody et. al.[23]	**-11.6**	-	**-13.9**	-	**-16.2**	-
Chiauzzi et al.[15]	-7.8	6.7	-9.5	5.1	**-14.8**	2.5
Lefort et al.[20]	**-16.1**	8.7	-	-	-	-
Moseley, Nicholas, Hodges[18]	-	6.6	-	-	-	-
Nicholas et al.[19]	**-12.3**	23.8	**-12.5**	20.4	-9.5	16.2
Ris et al.[25]	-	2.2	-	-	-	-
Rizzo et al.[16]	**-29.1**	**43.2**	-	-	-	-
Ryan et al.[17]	**-51.3**	**60.1**	-	-	-	-
Thorn et al.[21]	-	-	**-20.6**	-16.6	-	-

The figures in bold meet the inclusion criteria of at least 10% pain reduction and 30% improvement in function.

the frequency of the intervention themes. For the development of the cards of the board domains, the content addressed in at least 50% of the studies were selected.

Development of the *ConheceDor* game
For the development of the game *ConheceDor* game, we considered some examples of board games on the market that have a diversity of models, colors, shapes, and objectives. The game consists of a board, 110 cards, one die and the number of markers (pawns) according to the number of participants. The board layout was rectangular measuring 250mm by 500mm, with 50 houses, consisting of a path signaled by the words "Start" and "End," shortcuts, symbols and drawings (Figure 3).
The visual identity of the game *ConheceDor* is mainly composed of the colors green, yellow and red to attract the eyes to the board. The character present in the identity represents a young man with pain positioned on the spot that the game begins. Along the way, there are several aspects related to pain such as sleep, negative thoughts, drug use, and exercises until the end of the course where the character is illustrating his recovery. The presence of these graphic elements suggests that the theme of the game exemplifies a person with pain until the recovery.
The number of game houses available on the market that were evaluated during the *ConheceDor* game development goes from 40 to 60. Therefore, the 50 houses for the *ConheceDor* game were divided into colors (blue, orange, green, red and black), houses "choose your way" and "X" houses. The colors of the houses that represent the game domains were defined by consensus among the developers: negative thoughts (kinesiophobia and catastrophization) (orange), pain neurophysiology (green), stress man-

agement (black) relaxation/coping (blue) and physical exercises/activities (red). The game cards were divided into domain cards according to the colors of the board houses and "X" cards. For the house "choose your way," the player can choose any of the cards of the five domains to respond. The game cards assess the pain knowledge based on "true or false" answers where the player will judge whether a particular statement is beneficial or harmful to a person with pain. The statements used in the game cards were developed based on the scales and questionnaires used to assess patients with pain such as the Tampa Scale of kinesiophobia (TSK), Pain Catastrophizing Scale, Self-efficacy Scale, the Neurophysiological Pain Questionnaire and Attitudes to Pain. When the scales used questions, they have been converted into statements. In house X the player is punished that can be to stay one round without playing or to return some houses according to the result obtained when throwing the dice. All cards are rectangular with a dimension of 90mm x 60mm, printed on millboard, totaling 110 cards being 20 cards per domain and 10 X cards (Figure 3).
In the beginning, players (maximum of 4) are invited to set the order of the match by throwing the dice. The participant who obtains the highest number will be the first to start the match, followed by the participant with the second highest result, and so on. When moving his marker, the player must follow the command according to the house of the board that can be one of the domain cards, "choose your way" and house "X." The other player will read the card and indicate the correct answer after the first player has answered. If the player's answer is correct, he will have the right to throw the dice once more. If the answer is wrong, he will switch to the other player. It is only allowed to throw the
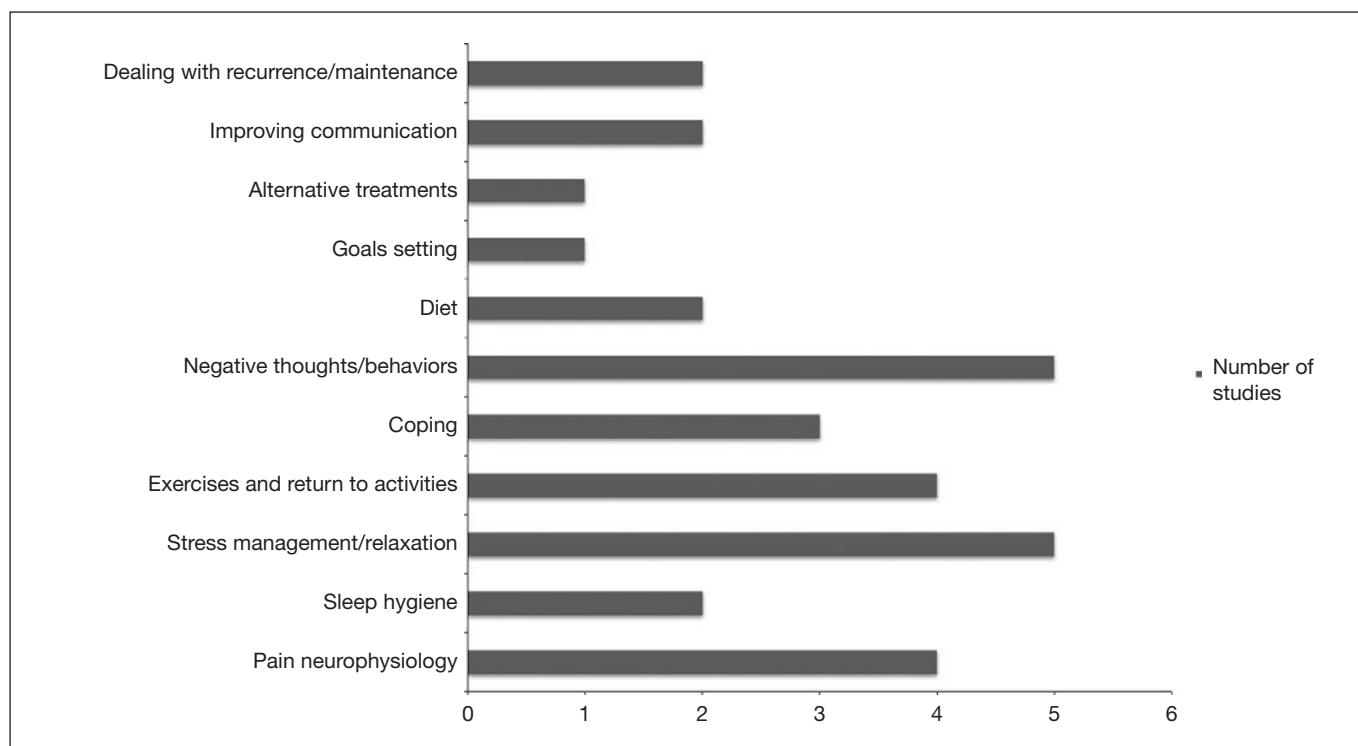

Figure 2. Absolute frequency of the themes in the interventions considering the studies included in the systematic review
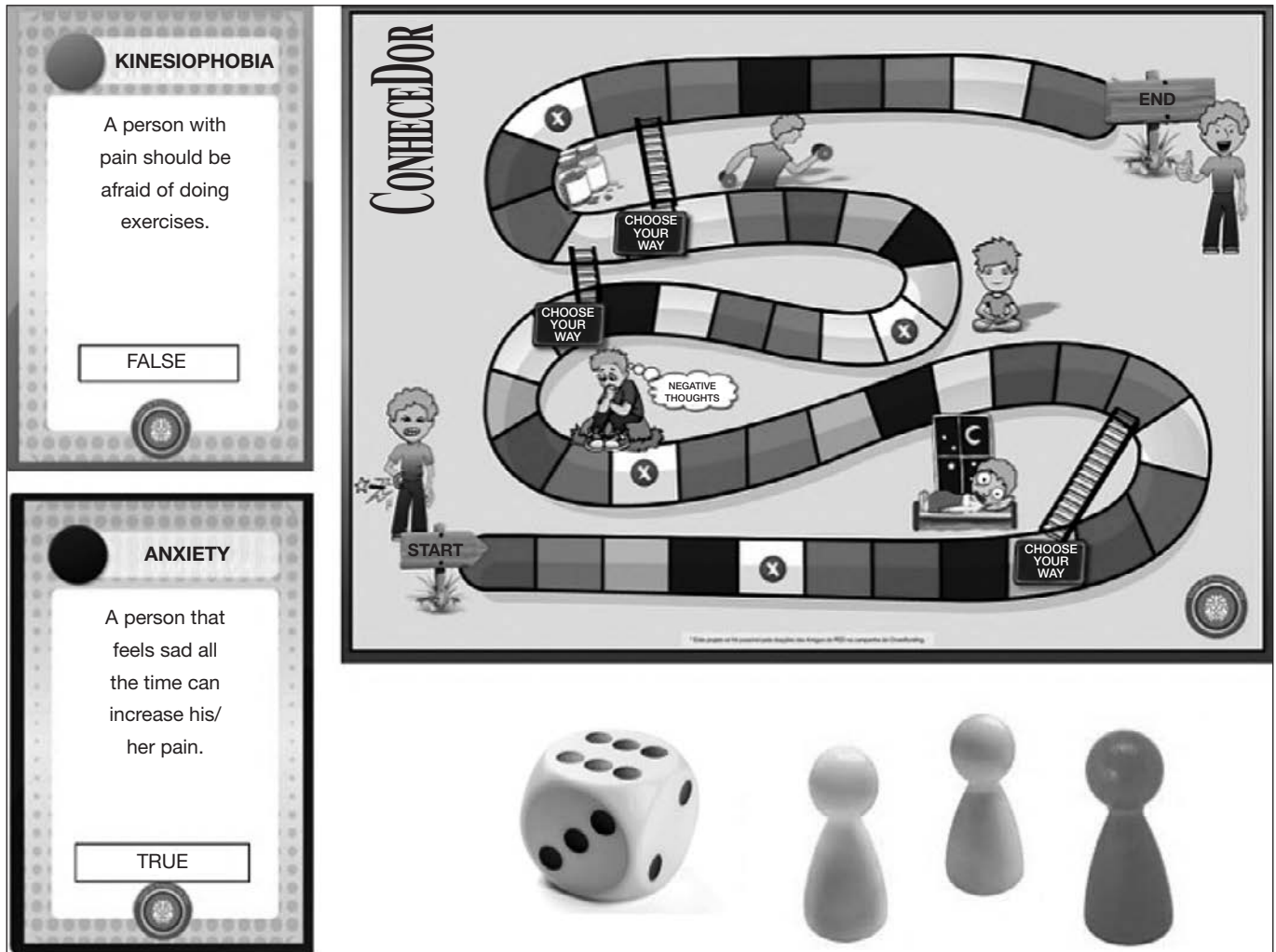
Figure 3. Components of the ConheceDor game (board, cards, dice, and pins)

dice twice, even if the player's answer is correct. In the "choose your way" house, the player can choose the card he wants to answer, and if the answer is correct, he will have the right to follow the "shortcut," shortening his path. The winner will be the one who arrives first at the "FIM" (End) house.

DISCUSSION

The systematic review of the clinical trials conducted in the present study identified the contents used in PE interventions based on neuroscience and behavioral strategies that contributed to the improvement of pain and disability in people with musculoskeletal pain. In the analysis of the 15 studies that met the inclusion criteria, it was observed that the main contents included the handling of negative thoughts and behavior, pain neurophysiology, stress management and relaxation techniques, coping strategies, exercises and return to activities. A study carried out in Salvador developed a PE booklet addressing the following topics: pain definition, pain classification (acute and chronic), living with pain, myths about pain, strategies for dealing with pain[30].

The reduction of pain and disability was assessed in the short term (up to three months) by most studies, three studies evaluated in the medium term (three to six months) and five studies in the long term (longer than six months). The reduction in pain intensity ranged from 6.7 to 51.3% and the improvement in disability from 2.2 to 60%. It is possible that this difference among the studies was due to the characteristics of the population (for example, the health condition addressed), the content of the intervention and the form of administration.

The present study did not seek to investigate the effectiveness of the neuroscience-based PE since other studies have already presented these results[11,31,32]. In the meta-analysis conducted by Geneen et al.[32], which included different types of educational interventions, the authors did not identify the effect of education on pain intensity relative to the comparison group immediately after and within three months of follow-up. However, for disability, when using neuroscience-based PE, there was evidence of significant improvement immediately after. This effect was not observed in the other types of education investigated in the studies. Other findings in the review by Geneen et al.[32] included significant improvement in catastrophizing and pain

awareness only in the studies that used neuroscience-based PE. The systematic review by Louw et al.[11] showed that neuroscience-based PE improved the knowledge about pain, disability, catastrophizing, pain-related fear, attitudes and behaviors related to pain, return to activities, and decreased the use of Health Services. However, the heterogeneity of the studies was not considered, and the meta-analysis was not performed. Recently, in a systematic review with meta-analysis, it was identified the evidence of moderate quality that the addition of PE to physiotherapy promoted short-term improvement in pain and also moderate evidence for the improvement of disability when PE was conducted isolated or combined with physiotherapy. For the kinesiophobia and catastrophizing outcomes, the authors found no statistical or clinical difference[31].

The objective of the elaboration of the board game was to develop an educational tool with an interactive interface, facilitating the understanding of theoretical contents about pain and behavioral strategies. Games are considered an active and useful tool in the teaching-learning process of patients. This is only possible because the playfulness allows the acquisition of the concepts attractively and pleasantly. Another characteristic of games is the horizontal relationship between the educator and the learner since games stimulate the interaction among participants, as well as motivating and supporting learning[33]. However, it should be noted that it is still necessary to validate the game with the target audience. During the validation process, it is essential to introduce the game to the target audience so they can evaluate the layout of the game that includes the shape of the board, the colors of the houses, the cards (both their format and the clarity of the information) and the playability that relates to how enjoyable the game is, the time it takes to play and the clarity of the rules. In this way, it is possible that the game needs some modifications after being submitted to this validation process.

Although the development and use of board games in the health area are not very frequent, the few that exist have shown positive results about the learning and education of patients[33]. There are some examples of games in the literature, such as a board game aimed at promoting active and healthy aging. This game acted like a playful pedagogical resource in nursing care, contributing to the construction of knowledge in the elderly health area[34]. Fernandes et al.[35] described the development of a board game called "Family Nursing Game" aimed at nurses. The participants emphasized the preference for the game, due to the source of interaction and reflection it allows among the participants and for having motivated family care. Pires and Guilhem[36], developed a board game titled "(IN) DICA-SUS" and realized that the learning sought by the paths of the game for health professionals contemplates the plural aspects of human formation, such as group interaction, active participation, the capacity for self-reflection, the motivation for the study and the willingness to achievement.

It is possible that the intervention strategies using board games have the potential to improve the knowledge about the theoretical content and to facilitate the acquisition or modification of behaviors. During the game, the relationship established between the game and the knowledge is comprehensive due to the numerous cognitive and social phenomena that the game allows the player to experience such as problem-solving, language learning, role-playing, among others[37].

Although some PE interventions have already been developed for Brazil[30,38], it is believed that this is the first board game based on a systematic review and critical analysis of the studies on the subject. Also, the characterization of these interventions allowed the development of a board game with previously used content that has demonstrated its effects, especially for pain and disability in people with musculoskeletal pain, based on studies with good methodological quality (PEDro≥6). Thus, this study can contribute by filling a gap in the literature that is the development of educational strategies easy to apply to people with pain. However, this study is not free of limitations either. The biggest was not having conducted the content validation process by a panel of experts and a sample of the target audience. This is a step that should occur after the development of the game, and then the effectiveness of the intervention should be compared to other forms of educational strategies. Therefore, new studies are necessary to evaluate the acceptability, usability, and applicability of the board game by patients and health professionals. These subsequent studies can significantly contribute to fix any issues and to enhance to the board game.

CONCLUSION

The systematic review followed by the evaluation of the content of the educational interventions allowed to identify the main themes used in clinical trials. This process contributed to the development of a board game for PE that may be a tool to be applied in the clinical practice to treat people with musculoskeletal pain.

Annex 1. Search strategy

#1 MeSH descriptor: [Chronic Pain] explode all trees
#2 MeSH descriptor: [Pain] explode all trees
#3 Widespread Chronic Pain
#4 MeSH descriptor: [Patient Education as Topic] explode all trees
#5 Patient Education or Education of Patients
#6 Education or neuroscience or neurobiology or neurophysiology or pain education or pain science or modern pain education or therapeutic neuroscience education
#7 MeSH descriptor: [Behavior Therapy] explode all trees
#8 Randomised controlled trial or clinical trial as a topic or randomised or placebo or randomly or trial
#9 #1 or #2 or #3
#10 #4 or #5 or #6 or #7
#11 #8 and #9 and #10

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