








## Association between professional qualification of physical therapists and perception of knee osteoarthritis treatment: a cross-sectional study

## Associação entre qualificação profissional de fisioterapeutas e a percepção sobre o tratamento de osteoartrite de joelho: um estudo transversal

Nívea Renata Oliveira Monteiro<sup>1</sup>   
Débora Juliana do Rosário<sup>2</sup>   
Vânia Tiê Koga Ferreira<sup>3</sup>   
Daniela Gonçalves Ohara<sup>4</sup> 

Maycon Sousa Pegorari<sup>5</sup>   
Império Lombardi Júnior<sup>6</sup>   
Areolino Pena Matos<sup>7</sup> 

<sup>1-5</sup>Universidade Federal do Amapá (Macapá). Amapá, Brazil. ni.vea.ap@hotmail.com, deborajuliana720@gmail.com, vaniatie@gmail.com, dani\_ohara@hotmail.com, mayconpegorari@yahoo.com.br

<sup>6</sup>Universidade Federal de São Paulo (São Paulo). São Paulo, Brazil. imperiolombardi@gmail.com

<sup>7</sup>Corresponding author. Universidade Federal do Amapá (Macapá). Amapá, Brazil. areolino.matos@gmail.com

**ABSTRACT | INTRODUCTION:** Osteoarthritis (OA) is the most prevalent form of arthritis, which requires appropriate therapeutic intervention. Physical therapy plays a central role in its management. However, little is known about the beliefs and interventions of physical therapists who treat OA in Brazil and factors related to clinical decisions. **OBJECTIVE:** To determine whether there is an association between the professional qualification of physical therapists in the North Region of Brazil and their perception of efficiency or inefficiency of therapeutic interventions for knee OA. **METHODS:** A cross-sectional online survey was conducted with physical therapists from five states in northern Brazil, and their perception about 20 interventions was assessed through a hypothetical case of knee OA. Statistical analyses were performed using the chi-square test and binary logistic regression with a significance level of 5%. **RESULTS:** 370 professionals with a mean age of 32.16 ± 6.89 responded to the survey. There was a significant association between qualification and perceived efficiency of interventions. Graduated physiotherapists were less likely to recognize ultrasound, short waves, transcutaneous electrical neurostimulation and electrical stimulation, cryotherapy, heat, muscle strengthening, kinesio taping, and rest as ineffective interventions. The same occurred for ultrasound, muscle strengthening, and kinesiology tape for specialists. **CONCLUSION:** The lower academic degree leads to a lower chance to perceive as poorly efficient or inefficient some not recommended interventions for knee OA.

**KEYWORDS:** Health care surveys. Osteoarthritis, knee. Professional practice. Physical therapy modalities.

**RESUMO | INTRODUÇÃO:** A Osteoartrite (OA) é a forma mais prevalente de artrite e requer intervenção terapêutica adequada. A Fisioterapia desempenha um importante papel no manejo desta doença. No entanto, pouco se sabe sobre as crenças e intervenções de fisioterapeutas que tratam OA no Brasil e fatores relacionados às decisões clínicas. **OBJETIVO:** Determinar se existe associação entre a qualificação profissional de fisioterapeutas na região Norte do Brasil e a percepção de eficiência ou ineficiência de intervenções terapêuticas para OA de joelho. **MATERIAIS E MÉTODOS:** Uma pesquisa transversal online foi realizada com fisioterapeutas de cinco estados do Norte do Brasil e a percepção sobre 20 intervenções foi avaliada por meio de um caso hipotético de OA de joelho. O teste qui-quadrado e regressão logística binária com nível de significância de 5% foram utilizados para a análise estatística. **RESULTADOS:** 370 profissionais com média de idade de 32,16 ± 6,89 responderam a pesquisa. Houve associação significativa entre qualificação e percepção de eficiência das intervenções. Fisioterapeutas apenas graduados apresentaram menos chances de reconhecer ultrassom, ondas curtas, neuroestimulação elétrica transcutânea e estimulação elétrica, crioterapia, calor, fortalecimento muscular, *kinesio taping* e repouso como intervenções ineficazes. O mesmo ocorreu com as intervenções ultrassom, fortalecimento muscular e *kinesio taping* para especialistas. **CONCLUSÃO:** O menor grau acadêmico leva à uma chance menor de perceber como pouco eficientes ou ineficientes algumas intervenções não recomendadas para OA de joelho.

**PALAVRAS-CHAVE:** Inquéritos e questionários. Osteoartrite de joelho. Prática profissional. Modalidades de fisioterapia.

## Introduction

Osteoarthritis (OA) is the most common joint disease in the developed world and the major cause of chronic disability of peripheral joints<sup>1,2</sup>. Symptomatic knee OA is highly prevalent among older adults all over the world (10% to 30%) especially in rural regions with high physical labor demands<sup>3</sup>. In this age group, is the most common cause of disability, involving pain and limitation of activities of daily life<sup>4,5</sup>.

Given the high impact of OA on individual function and its social repercussions, there is a recognized need to apply high-quality treatments to this condition. Thus, several clinical guidelines are available to guide this type of care<sup>6-8</sup>. Surgical and pharmacological approaches are available, and non-pharmacological interventions such as Physical Therapy treatments that are considered being the main therapeutic choices for the disease<sup>8</sup>.

Approaches and beliefs of physical therapists (PTs) regarding knee OA treatment have been investigated in previous surveys. Holden et al. observed that a little more than half of the professionals (56%) agreed that exercises improve conditions of the knees and that their practice is the responsibility of the patient<sup>9</sup>. In another study it was observed that electrotherapy and ultrasound (US) is still used even though most of the physical therapists use exercises and patient education<sup>10</sup>. And, some studies have also demonstrated that professional-related determinants can influence these clinical decisions, two studies have indicated that the age of the professional is associated with their therapeutic choice, where older PTs are more likely to use interventions not recommended for knee OA<sup>10,11</sup>.

There is a lack of information about the professional practice of Brazilian physical therapists in the treatment of knee OA and potentially modifiable factors that may be associated with the perception of efficiency or inefficiency of therapeutic interventions to treat this condition. That kind of studies help us understand the type and quality of treatment received by the patients and allow us to contribute to the projection of the reach of scientific evidence among professionals in the country. Thus, this study aimed to determine whether there is an association between the professional qualification of physical

therapists in the Northern region of Brazil and their perceptions of efficiency or inefficiency of therapeutic interventions for knee OA.

This is the first study conducted in Brazil with this objective, and we hypothesize that professionals with different levels of professional qualification understand differently the efficiency of therapeutic interventions.

## Materials and methods

### Study design and sample

That was a cross-sectional, descriptive, and analytical survey with a quantitative approach described according to the initiative Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and was approved by the Research Ethics Human Beings Committee (Protocol: 1.989.417; CAEE 62673016.4.0000.0003).

A survey was conducted among PTs who treat patients with knee OA, registered in a Physical Therapy registration board and acting in five states in the Northern region of Brazil.

The sample size was calculated based on a prevalence of 50%. The calculation used the number of electronic contacts as the total population, with a sampling error of 5% and a 95% confidence level, reaching a minimum number of 363 necessary responses. Using a 50% prevalence for the sample calculation is a conservative strategy, considering that the prevalence of certain outcomes is unknown or if it is intended to plan a study with different outcomes of interest. Thus, for a precision, the prevalence of 50% for a given outcome provides the largest possible sample size is an estimate.

### The instrument for data collection

The authors built an electronic survey with 13 questions administered through the SurveyMonkey™ website ([www.surveymonkey.com](http://www.surveymonkey.com)). The instrument, applied between July 2017 and February 2018, was previously analyzed by six PTs researchers and clinicians, specialists in musculoskeletal and/or rheumatological

physical therapy, with a minimum experience of 10 years in the care of patients with knee OA. The group evaluated the content, possible ambiguities, technical terms, terminologies, time spent responding, and the structure of the tool. The suggestions were examined and included in the final version. A pilot study was conducted among 15 professors to assess and refine the mailing procedure and data collection.

The questionnaire contained an initial text requiring the provision of care to at least one patient with knee OA per month. Four more sections with 1) Socio-demographic data; 2) Information about professional training and clinical performance; 3) Analysis of the professional about the effectiveness of physical therapy interventions used in the treatment of knee OA (a hypothetical case of a patient with joint pain and dysfunction was used for these questions, 20 pre-defined therapeutic interventions were provided as an answer); 4) Sources of information and use of Evidence-Based Practice for the choice of treatments.

### Procedures

Data were collected via electronic contact. The invitation and electronic survey were sent to all PTs of five states of the Northern region of the country. Those were given a period of up to three weeks to respond to it.

### Statistical analysis

Data was imported to the Statistical Package for the Social Sciences software (SPSS Version 25.0. IBM Inc, Chicago, IL, USA). Categorical variables were analyzed as absolute and percent frequencies and numerical variables were analyzed as mean and standard deviation. The chi-square test was used to determine the association of the variables' outcome of interest (the type of treatment and options: efficient/very efficient or inefficient/poorly efficient) with the independent variables (graduation, specialization/residency, and master's/doctorate) and a binary logistic regression model was used for the odds ratio estimates, with the level of significance set at 5% ( $p < 0.05$ ) and with a 95% confidence interval (95%CI).

### Results

Table 1 shows the characteristics of physical therapists who answered the study. 370 professionals responded to the full survey, with a response rate of 5.88%. Most of them were women (64.59%) aged on average  $32.16 \pm 6.89$  years, with specialization lato sensu or residency (58.11%), and less than 14% of the respondents had stricto sensu post-graduation. The participation of professionals by the state was 42.9% from Pará, 23.2% respondents from Amazonas, 17.2% from Amapá, 11.8% responded from Tocantins, and 4.55% from the state of Roraima.

**Table 1.** Characteristics of physical therapists who responded to the survey

| Variables  | Total sample (n=370) |
|--|----------------------|
| <b>Age (years <math>\pm</math>SD)</b>                          | 32.16 $\pm$ 6.89     |
| <b>Gender</b>  |                      |
| Male   | 131 (35.4)           |
| Female   | 239 (64.5)           |
| <b>Time of professional license (years <math>\pm</math>SD)</b> | 6.8 $\pm$ 5.61       |
| <b>Qualification</b>   |                      |
| Graduation   | 101 (27.3)           |
| Specialization/residency                                       | 215 (58.1)           |
| Master's degree  | 47 (12.0)            |
| Doctorate  | 7(1.9)               |
| <b>Do you have specific training for OA treatment?</b>         |                      |
| Yes  | 245 (66.2)           |
| No   | 125 (33.7)           |

SD: Standard Deviation; OA: Osteoarthritis

Table 2 shows the association of professional qualification and perception of efficiency or inefficiency of the interventions. Regardless of qualification, the highest percentage of PTs considered the following therapies to be efficient or very efficient: muscle strengthening, Ultrasound, TENS and electrical stimulation, and cryotherapy. Short-wave diathermy, kinesiology tape, and rest were considered being efficient by graduates and specialists, but inefficient or poorly efficient by holders of a master's degree and doctors. Graduated physical therapists considered heat and whirlpool therapies to be efficient or very efficient, whereas physical therapists with specialization/residency and a master's degree/doctorate considered them to be inefficient or poorly efficient ( $p < 0.05$ ).

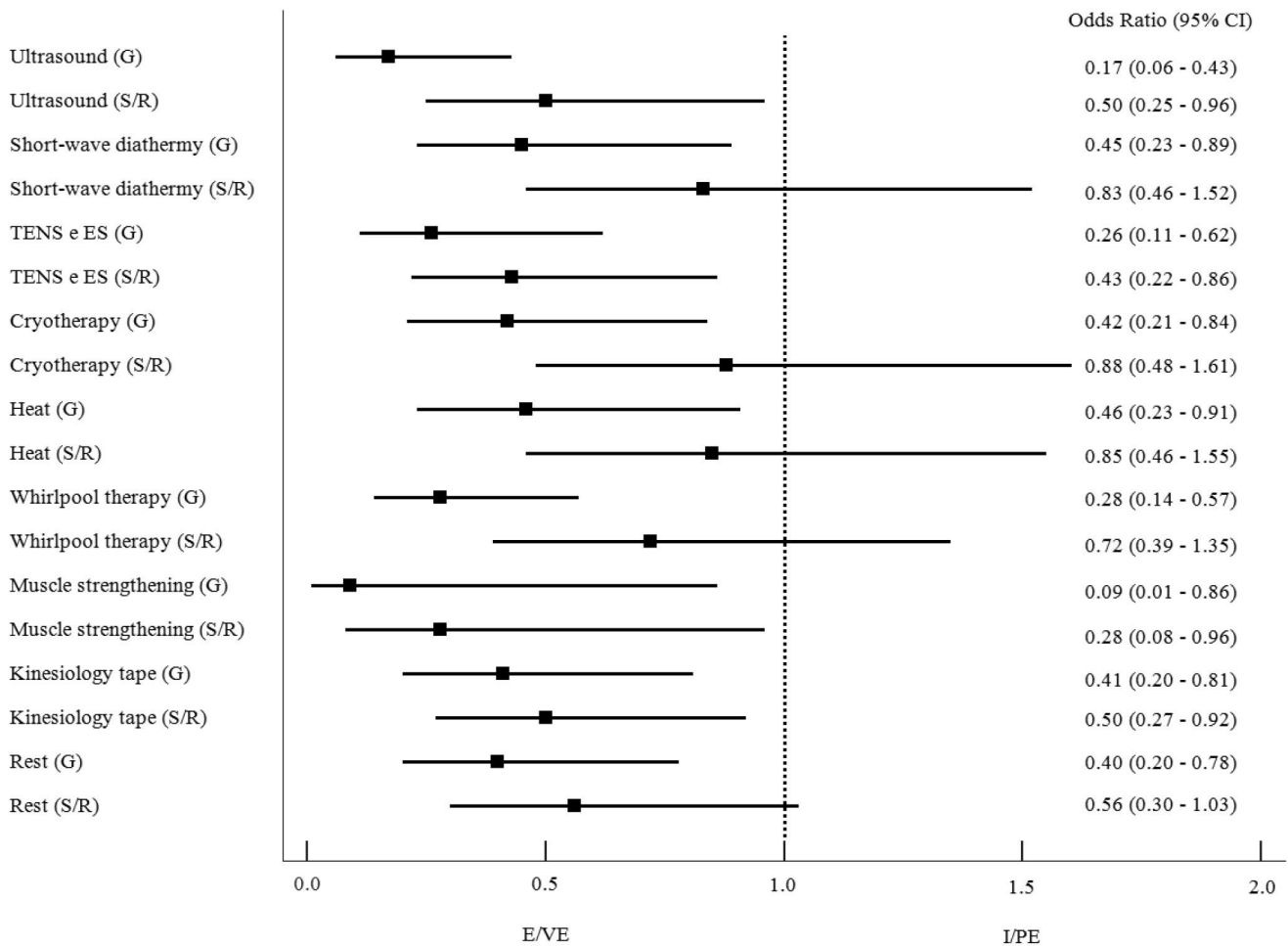
**Table 2.** Association between professional qualification and perception of efficiency or inefficiency of the interventions

| Variables                    | Professional Qualification |          |                              |           |                              |          |               |           | p      |
|------------------------------|----------------------------|----------|------------------------------|-----------|------------------------------|----------|---------------|-----------|--------|
|                              | Graduation                 |          | Specialization/<br>Residency |           | Master's<br>degree/Doctorate |          | Total         |           |        |
|                              | VE/E<br>n (%)              | I/PE     | VE/E<br>n (%)                | I/PE      | VE/E<br>n (%)                | I/PE     | VE/E<br>n (%) | I/PE      |        |
| Ultrasound                   | 93(30.9)                   | 8(11.6)  | 172(57.1)                    | 43(62.3)  | 36(12)                       | 18(26.1) | 301(81.4)     | 69(18.6)  | 0.001* |
| LASER                        | 81(28.2)                   | 20(24.1) | 168(58.5)                    | 47(56.6)  | 38(13.2)                     | 16(19.3) | 287(77.6)     | 83(22.4)  | 0.359  |
| Short-wave diathermy         | 66(36)                     | 35(20.6) | 109(54.5)                    | 106(62.4) | 25(12.5)                     | 29(17.1) | 200(54.1)     | 170(45.9) | 0.024* |
| TENS/Electrical stimulation  | 90(29.4)                   | 11(17.2) | 179(58.5)                    | 36(56.3)  | 37(12.1)                     | 17(26.6) | 306(82.7)     | 64(17.3)  | 0.005* |
| Cryotherapy                  | 74(32.9)                   | 27(18.6) | 122(54.2)                    | 93(64.1)  | 29(12.9)                     | 25(17.2) | 225(60.8)     | 145(39.2) | 0.005* |
| Heat                         | 62(33.5)                   | 39(21.1) | 100(54.1)                    | 115(62.2) | 23(12.4)                     | 31(16.8) | 185(50)       | 185(50)   | 0.024* |
| Whirlpool                    | 66(37.3)                   | 35(18.1) | 92(52)                       | 123(63.7) | 19(10.7)                     | 35(18.1) | 177(47.8)     | 193(52.2) | 0.000* |
| Aerobic exercises            | 56(27.2)                   | 45(27.4) | 121(58.7)                    | 94(57.3)  | 29(14.1)                     | 25(15.2) | 206(55.7)     | 164(44.3) | 0.942  |
| Floor-based exercises        | 50(24.5)                   | 51(30.7) | 126(61.8)                    | 89(53.6)  | 28(13.7)                     | 26(15.7) | 204(55.1)     | 166(44.9) | 0.276  |
| Muscle strengthening         | 100(27.9)                  | 1(8.3)   | 209(58.4)                    | 6(50)     | 49(13.7)                     | 5(41.7)  | 358(96.8)     | 12(3.2)   | 0.018* |
| Hydrotherapy                 | 99(27.7)                   | 2(15.4)  | 206(57.7)                    | 9(69.2)   | 52(14.6)                     | 2(15.4)  | 357(96.5)     | 13(3.5)   | 0.609  |
| Canes and crutches           | 47(27.3)                   | 54(27.3) | 97(56.4)                     | 118(59.6) | 28(16.3)                     | 26(13.1) | 172(46.5)     | 198(53.5) | 0.675  |
| Shoes                        | 69(27)                     | 32(28.1) | 155(60.5)                    | 60(52.6)  | 32(12.5)                     | 22(19.3) | 256(69.2)     | 114(30.8) | 0.184  |
| Orthoses, braces and insoles | 63(27.9)                   | 38(26.4) | 131(58)                      | 84(58.3)  | 32(14.2)                     | 22(15.3) | 226(61.1)     | 144(38.9) | 0.928  |
| Medicinal herbs              | 26(23.2)                   | 75(29.1) | 73(65.2)                     | 142(55)   | 13(11.6)                     | 41(15.9) | 112(30.3)     | 258(69.7) | 0.188  |
| Acupuncture                  | 70(28.2)                   | 31(25.4) | 137(55.2)                    | 78(63.9)  | 41(16.5)                     | 13(10.7) | 248(67)       | 122(33)   | 0.198  |
| Kinesiology tape             | 70(29.8)                   | 31(23)   | 139(59.1)                    | 76(56.3)  | 26(11.1)                     | 28(20.7) | 235(63.5)     | 135(36.5) | 0.029* |
| Patient education            | 98(26.8)                   | 3(60)    | 214(58.6)                    | 1(20)     | 53(14.5)                     | 1(20)    | 365(98.6)     | 5(1.4)    | 0.198  |
| Rest                         | 62(31.5)                   | 39(22.5) | 114(57.9)                    | 101(58.4) | 21(10.7)                     | 33(19.1) | 197(53.2)     | 173(46.8) | 0.028* |
| Manual therapy               | 83(2.4)                    | 18(26.9) | 179(59.1)                    | 36(53.7)  | 41(13.5)                     | 13(19.4) | 303(81.9)     | 67(18.1)  | 0.456  |

VE/E: Very Efficient/Efficient; I/PE: Inefficient/Poorly efficient; TENS: Transcutaneous Electrical Nerve Stimulation; Chi-square test; \* $p < 0.05$ ; The total number and percentage of participants is the sum of ME / E responses from each group and I / PE from each group, for each therapy (line).

Figure 1 shows the odds ratios and their respective confidence intervals (95% CI) for interventions that showed a significant difference in the previous analysis (Table 2). For this situation, the Master's degree/Doctorate category was taken as a reference for the categories Graduation and Specialization/Residency.

**Figure 1.** Association between professional qualification and perception of efficiency or inefficiency of interventions with significant differences



TENS: Transcutaneous electrical nerve stimulation; ES: Electrical stimulation; G: Graduation; S/R: Specialization/Residency; Master`s by research / Doctorate: reference category; OR: Odds Ratio; E/VE: Efficient/Very Efficient; I/PE: Inefficient/Poorly Efficient.

Logistic regression analysis showed an inverse association between graduation category and interventions (US, short-wave diathermy, TENS and electrical stimulation, cryotherapy, heat, whirlpool, muscle strengthening, kinesiology tape, and rest), suggesting that holding this qualification level reduces the odds ratios of considering the therapies inefficient or poorly efficient for knee OA treatment. The same association was observed for the Specialization/Residency group regarding US, TENS and electrical stimulation, muscle strengthening, and kinesiology tape (Figure 1).

No significant differences were observed regarding the other therapies listed on the survey form.



## Discussion

The results of the present survey among 370 physical therapists in the Northern region of Brazil show that the qualification of professionals was associated with what they consider being efficient or inefficient interventions for knee OA treatment. Our results showed that all interventions concerning electrotherapy, thermotherapy, except laser, were associated with the physical therapist's qualification, especially among graduated professionals. Apparently, despite more recent evidence indicating the low effectiveness of these techniques<sup>12,13</sup>, the belief in passive therapies with the use of equipment still permeates the theoretical basis of many professionals, thus suggesting that evidence-based practice is not currently being approached or appropriated implemented in disciplines for academic training in this region of Brazil.

Interpreting electrotherapy and US as efficient modalities by a part of the PTs contacted in our study is not an unheard result. Walsh e Hurley detected that 66% of a group of physical therapists in the United Kingdom mentioned the electrotherapeutic modalities as the second most used intervention for the knee OA treatment<sup>14</sup>. Besides electrothermotherapy, programs of therapeutic exercises were mentioned as recurrent interventions. These, however, are recognized as an efficient therapy for the OA treatment enhancing muscle strength, range of motion, and aerobic capacity, and consequently improving pain, function, and quality of life<sup>15</sup>. Muscle strengthening, a widely recommended exercise<sup>16-18</sup>, was found to be strongly associated with graduates and specialists. Fortunately, this aspect reveals that this intervention was recognized as efficient or very efficient by almost all respondents.

Surprisingly, our results showed that kinesiology taping and rest were considered efficient interventions by 63.5% and 53.2% of the participants, respectively. Unlike in another survey with PTs of the United Kingdom, where these interventions were the less used<sup>19</sup>. Graduated PTs showed a 60% lower chance to consider rest as a poorly efficient or inefficient intervention for knee OA treatment. This is worrying, it means that a large part of graduates may indicate

and using rest as a treatment, even though rest is widely known to be inefficient and harmful. Clinical recommendations indicate exactly the opposite, recommending regular programs of physical exercise, to help control symptoms and body weight without the risk of the side effects of medications<sup>20</sup>.

Clinical decision-making is a topic of frequent interest among clinicians and researchers. Costa et al. investigated how PTs decided about their interventions. Authors identified that professionals who followed the principle of evidence-based practice were more likely to use therapeutic exercise and education and less likely to use US and electrotherapy<sup>10</sup>.

We emphasize that the average time of professional activity, in our study, was 6.8 years, and, according to the answers, these professionals are not up to date on the best evidence about the knee OA treatment. Health professionals must continue to update themselves, both in courses aimed at specific areas, such as musculoskeletal, and in interpreting guidelines<sup>21,22</sup>, and scientific papers, basing physical therapy treatment on the best available scientific evidence and reducing the risk of use treatments that do not benefit patients.

In the training's context of health professionals in Brazil, we understand that, perhaps, it is necessary to improve teaching in the graduation of physiotherapy courses, with teaching strategies focusing on the more active participation of students and teachers. Including these strategies improves training and encourages professional development<sup>23,24</sup>. Brazil is a country of huge territorial dimensions and with great cultural and economic diversity. The distance between cities in the northern region and more economically developed Brazilian regions and the limited internet access in some municipalities of the region may contribute to discrepancies between the perception of the efficiency of some therapies and guideline recommendations to treat the disease.

A major strength of the study is that physical therapy management was evaluated using a wide range of possible interventions. The present survey highlights results that may help to identify and understand the judgment of PTs from this region of Brazil regarding

the use and efficiency of OA interventions, and possible gaps in their training or updating methods for professional practice. It may also be helpful for the reevaluation and reformulation of the forms and contents of the disciplines for student training regarding the therapeutic interventions for rheumatological and musculoskeletal conditions. Therefore, the authors suggest that further investigations are needed in an attempt to identify the cause of these discrepancies between what a PT considers being efficient and uses in daily clinical practice and what is supported by evidence as a better therapeutic intervention and to stimulate the evidence-based practice among these professionals.

The research has limitations. This is a cross-sectional study, which does not allow determining causal relationships for the observed discrepancies. The data collected by self-report may contribute to excessively positive replies by professionals concerning their own interventions treating knee OA, characterizing a social desirability bias. We cannot confirm that this happened, because no instrument was used to evaluate this bias, as suggested by Perinelli and Gremigni<sup>25</sup>.

## Conclusion

There was an association between the level of professional qualification of physical therapists in the Northern region of Brazil and their appraisal of the efficiency or inefficiency of interventions on knee OA. These results indicate that, the lower the professional academic level, the lower the chances of physical therapists to perceive therapeutic modalities not recommended for treatment of this disease as being poorly efficient or even inefficient.

## Author contributions

All authors contributed substantially to the construction of the project, data collection, data analysis and interpretation, writing of the article, review and final approval of the version to be published.

## Competing interests

No financial, legal, or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory council, study design, preparation of the manuscript, statistical analysis, etc.).

## References

1. Glyn-Jones S, Palmer AJR, Agricola R, Price AJ, Vincent TL, Weinans H, et al. Osteoarthritis. *Lancet*. 2015;386(9991):376-87. [https://doi.org/10.1016/S0140-6736\(19\)30417-9](https://doi.org/10.1016/S0140-6736(19)30417-9)
2. Plotnikoff R, Karunamuni N, Lytvyak E, Penfold C, Schopflocher D, Imayama I, et al. Osteoarthritis prevalence and modifiable factors: A population study Chronic Disease epidemiology. *BMC Public Health*. 2015;15(1):1195. <https://dx.doi.org/10.1186/s12889-015-2529-0>
3. Busija L, Bridgett L, Williams SRM, Osborne RH, Buchbinder R, March L, et al. Osteoarthritis. *Best Pract Res Clin Rheumatol*. 2010;24(6):757-68. <https://doi.org/10.1016/j.berh.2010.11.001>
4. Bijlsma JW, Berenbaum F, Lafeber FPJG. Osteoarthritis: an update with relevance for clinical practice. *Lancet*. 2011;377(9783):2115-26. [https://doi.org/10.1016/s0140-6736\(11\)60243-2](https://doi.org/10.1016/s0140-6736(11)60243-2)
5. Prieto-Alhambra D, Judge A, Javaid MK, Cooper C, Diez-Perez A, Arden NK. Incidence and risk factors for clinically diagnosed knee, hip and hand osteoarthritis: Influences of age, gender and osteoarthritis affecting other joints. *Ann Rheum Dis*. 2014;73(9):1659-64. <https://doi.org/10.1136/annrheumdis-2013-203355>
6. Fransen M, McConnell S, Harmer AR, Esch MVD, Simic M, Bennell KL. Exercise for osteoarthritis of the knee: A Cochrane systematic review. *Br J Sports Med*. 2015;49(24):1554-7. <https://doi.org/10.1136/bjsports-2015-095424>

7. Kolasinski SL, Neogi T, Hochberg MC, Oatis C, Guyatt G, Block J, et al. 2019 American College of Rheumatology/Arthritis Foundation Guideline for the Management of Osteoarthritis of the Hand, Hip, and Knee. *Arthritis Care Res.* 2020;72(2):149-62. <https://doi.org/10.1002/acr.24131>
8. McAlindon TE, Bannuru RR, Sullivan MC, Arden NK, Berenbaum F, Bierma-Zeinstra SM, et al. OARSJ guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthr Cartil.* 2014;22(3):363-88. <https://doi.org/10.1016/j.joca.2014.01.003>
9. Holden MA, Nicholls EE, Young J, Hay EM, Foster NE. UK-based physical therapists' attitudes and beliefs regarding exercise and knee osteoarthritis: Findings from a mixed-methods study. *Arthritis Rheum.* 2009;61(11):1511-21. <https://doi.org/10.1002/art.24829>
10. Costa BR, Vieira ER, Gadotti IC, Colosi C, Rylak J, Wylie T, et al. How do physical therapists treat people with knee osteoarthritis, and what drives their clinical decisions? A population-based cross-sectional survey. *Physiother Can.* 2017;69(1):30-7. <https://dx.doi.org/10.3138%2Fptc.2015-83>
11. Spitaels D, Hermens R, Van Assche D, Verschueren S, Luyten F, Vankrunkelsven P. Are physiotherapists adhering to quality indicators for the management of knee osteoarthritis? An observational study. *Musculoskelet Sci Pract.* 2017;27:112-23. <https://doi.org/10.1016/j.math.2016.10.010>
12. Geenen R, Overman CL, Christensen R, Åsenlöf P, Capela S, Huisinga KL, et al. EULAR recommendations for the health professional's approach to pain management in inflammatory arthritis and osteoarthritis. *Ann Rheum Dis.* 2018;77(6):797-807. <https://doi.org/10.1136/annrheumdis-2017-212662>
13. Zeng C, Li H, Yang T, Deng ZH, Yang Y, Zhang Y, et al. Electrical stimulation for pain relief in knee osteoarthritis: Systematic review and network meta-analysis. *Osteoarthr Cartil.* 2015;23(2):189-202. <https://doi.org/10.1016/j.joca.2014.11.014>
14. Walsh NE, Hurley MV. Evidence based guidelines and current practice for physiotherapy management of knee osteoarthritis. *Musculoskeletal Care.* 2009;7(1):45-56. <https://doi.org/10.1002/msc.144>
15. Yamato TP, Deveza LA, Maher CG. Exercise for osteoarthritis of the knee (PEDro synthesis). *Br J Sports Med.* 2016;50(16):1013-4. <http://dx.doi.org/10.1136/bjsports-2016-096104>
16. Bartholdy C, Juhl C, Christensen R, Lund H, Zhang W, Henriksen M. The role of muscle strengthening in exercise therapy for knee osteoarthritis: A systematic review and meta-regression analysis of randomized trials. *Semin Arthritis Rheum.* 2017;47(1):9-21. <https://doi.org/10.1016/j.semarthrit.2017.03.007>
17. Brosseau L, Taki J, Desjardins B, Thevenot O, Fransen M, Wells GA, et al. The Ottawa panel clinical practice guidelines for the management of knee osteoarthritis. Part two: Strengthening exercise programs. *Clin Rehabil.* 2017;31(5):596-611. <https://doi.org/10.1177/0269215517691084>
18. Imoto AM, Pardo JP, Brosseau L, Taki J, Desjardins B, Thevenot O, et al. Evidence synthesis of types and intensity of therapeutic land-based exercises to reduce pain in individuals with knee osteoarthritis. *Rheumatol Int.* 2019;39(7):1159-79. <https://doi.org/10.1007/s00296-019-04289-6>
19. Holden MA, Nicholls EE, Hay EM, Foster NE. Physical Therapists' Use of Therapeutic Exercise for Patients With Clinical Knee Osteoarthritis in the United Kingdom: In Line With Current Recommendations? *Phys Ther.* 2008;88(10):1109-21. <https://doi.org/10.2522/ptj.20080077>
20. Bannuru RR, Schmid CH, Kent DM, Vaysbrot EE, Wong JB, McAlindon TE. Comparative Effectiveness of Pharmacologic Interventions for Knee Osteoarthritis: a systematic review and network meta-analysis. *Ann Intern Med.* 2015;162(1):46-54. <https://doi.org/10.7326/m14-1231>
21. Davis D. Continuing education, guideline implementation, and the emerging transdisciplinary field of knowledge translation. *J Contin Educ Health Prof.* 2006;26(1):5-12. <https://doi.org/10.1002/chp.46>
22. Li LC, Hurkmans EJ, Sayre EC, Vliet Vlieland TPM. Continuing Professional Development Is Associated With Increasing Physical Therapists' Roles in Arthritis Management in Canada and the Netherlands. *Phys Ther.* 2010;90(4):629-42. <https://doi.org/10.2522/ptj.20080409>
23. Marques LMNSR. Active methodologies as strategies to develop education in values in nursing graduation. *Esc Anna Nery.* 2018;22(3):1-6. <https://doi.org/10.1590/2177-9465-ean-2018-0023>
24. Simon E, Jezine E, Vasconcelos EM, Ribeiro KSQS. Active teaching-learning methodologies and popular education: agreements and disagreements in the context of health professionals' education. *Interface Commun Heal Educ.* 2014;18(Suppl.2):1355-64. <https://doi.org/10.1590/1807-57622013.0477>
25. Perinelli E, Gremigni P. Use of Social Desirability Scales in Clinical Psychology: A Systematic Review. *J Clin Psychol.* 2016;72(6):534-51. <https://doi.org/10.1002/jclp.22284>