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Interventional rheumatology: the competence of Brazilian rheumatologists



Aline Teixeira de Landa, Jamil Natour, Rita Nely Vilar Furtado*

Universidade Federal de São Paulo, Escola Paulista de Medicina, Disciplina de Reumatologia, São Paulo, SP, Brazil

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ABSTRACT

Objectives: Describe Brazilian rheumatologists's competence in interventional rheumatology; assess the association between this ability and demographic and training variables.

Methods: A cross-sectional study with 500 Brazilian rheumatologists. Participants were assessed by self-administered questionnaire consisting of demographics, training, practice in office and knowledge in interventional rheumatology data.

Results: 463 participants had their data analyzed. The mean age was 40.2 years (± 11.2). 70% had performed periarticular injections and 78% had performed intra-articular injections. The sample was divided into three groups: non-interventionist, little interventionist and very interventionist. The non-interventionist group showed ($p < 0.001-0.04$) higher mean age, lower proportion of university bond, lower training history, higher proportion of graduates in the Southeast country, and higher proportion of graduates in the 1980s to 1989. The very interventionist group showed higher ($p < 0.001-0.018$) proportion of adult rheumatologists, higher proportion of university bond, longer training time with greater practice of complex procedures, and higher proportion of graduates, trained and with private practice in the South country. Variables most associated with the very interventionist subgroup are performing axial intra-articular injections (OR: 7.4, $p < 0.001$), synovial biopsy (OR: 5.75, $p = 0.043$), image-guided IAI (OR: 4.16, $p < 0.001$), viscosupplementation (OR = 3.41, $p < 0.001$), joint lavage (OR = 3.22, $p = 0.019$), salivary gland biopsy (OR = 2.16, $p = 0.034$) and over 6-month training (OR: 2.16, $p = 0.008$).

Conclusions: Performing more complex invasive procedures and over 6-month training in interventional rheumatology were variables associated with enhanced interventional profile.

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* Corresponding author.

E-mail: rvfurtado@hotmail.com (R.N. Furtado).

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Reumatologia intervencionista: competência dos reumatologistas brasileiros

R E S U M O

Palavras-chave:
Injeção articular
Competência
Reumatologista
Treinamento

Objetivos: Descrever a competência dos reumatologistas brasileiros na reumatologia intervencionista (RI); avaliar a associação entre essa capacidade e variáveis demográficas e de treinamento.

Métodos: Fez-se um estudo transversal com 500 reumatologistas brasileiros. Os participantes foram avaliados por questionário autoadministrado, constituído por dados demográficos, treinamento, prática em consultório e conhecimento em dados de RI.

Resultados: Analisaram-se os dados de 463 participantes. A média foi de 40,2 anos ($\pm 11,2$). Desses, 70% fizeram injeções periarticulares (IPA) e 78% intra-articulares (IAI). A amostra foi dividida em três grupos: não intervencionista, pouco intervencionista e muito intervencionista. O grupo não intervencionista apresentou ($p < 0,001 - 0,04$) maior média de idade, menor proporção de vínculo universitário, menor história de treinamento, maior proporção de graduados na Região Sudeste do país e maior proporção de graduados nas décadas de 1980 a 1989. O grupo muito intervencionista apresentou ($p < 0,001 - 0,018$) maior proporção de reumatologias que atendem pacientes adultos, maior proporção de vínculo universitário, maior tempo de treinamento de prática de procedimentos complexos, maior proporção de graduados no sul do país, treinados e com consultório particular nessa região. As variáveis mais frequentemente associadas ao subgrupo muito intervencionista foram feitura de IAI axial (OR: 7,4, $p < 0,001$), biópsia sinovial (OR: 5,75, $p = 0,043$), IAI guiada por imagem (OR: 4,16, $p < 0,001$), viscosuplementação (OR = 3,41, $p < 0,001$), lavagem articular (OR = 3,22, $p = 0,019$), biópsia da glândula salivar (OR = 2,16, $p = 0,034$) e mais de seis meses de treinamento (OR: 2,16; $p = 0,008$).

Conclusões: Fazer procedimentos invasivos mais complexos e ter mais de seis meses de treinamento em RI foram as variáveis associadas a um melhor perfil intervencionista.

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Introduction

Rheumatology is considered only a clinical specialty by many. But in fact, the practice involves a series of interventions that assist the physician in the diagnosis and treatment of rheumatic diseases. Interventional rheumatology has been part of the expertise for over half a century, when the practice of intra-articular injection (IIA) with corticosteroids (CSs) began.¹ This remains the most common procedure performed by rheumatologists nowadays. The periarticular injections (PIs) with CSs can be used for the treatment of inflammatory soft tissue as the first choice or even in refractory cases. The use of image techniques can improve the effectiveness of joint injection, both intra- and periarticular. Other procedures related to patient diagnosis include synovial, bone, muscle, and salivary gland biopsies.²⁻⁵

There are few studies evaluating the intervention's competence of rheumatologists throughout the world.⁶⁻⁸ Some studies focus on rheumatologist's competence to perform musculoskeletal ultrasound (MU) for diagnostic purposes or for guiding procedures.⁹⁻¹³

There are no published studies evaluating the theoretical competence in interventional rheumatology among Brazilian rheumatologists. It is believed that there is a large heterogeneity in training to perform osteoarticular procedures in Brazil.

The aims of this study were to describe the competence of Brazilian rheumatologists in interventional rheumatology, assess the association between their competence and demographic variables, and between their educational training in order to try to identify variables associated with more interventional rheumatologists.

Methods

This was a cross-sectional study reviewed and approved by the Ethics Committee of the Universidade Federal de São Paulo, São Paulo, Brazil. Five hundred Brazilian rheumatologists were randomly selected and assigned to participate in the study. Participants were selected during the most important annual Rheumatology meeting of the Rheumatology Brazilian Society conducted in the southeast region of Brazil.

The following inclusion criteria were used: being a rheumatologist or a student in the final year of Residency in rheumatology and signing the informed consent. The study's exclusion criterion was not being a rheumatologist (medical students, resident physicians in other specialties, medical experts in other areas, and without specific medical specialty).

Assessment

Participants were assessed through self-administered questionnaire. The questionnaire consisted of two parts: the first related to the demographic characteristics and training in interventional rheumatology and the second related to the competence in interventional rheumatology.

The first part of the questionnaire consisted of the following items: age; venue and year of graduation; institution of residency/specialization in rheumatology; title of specialist in rheumatology, masters or PhD degrees; university bond and private practice.

The second part of the questionnaire comprised the following items related to practice in interventional rheumatology: training in invasive procedures during medical residency/specialization; practice in invasive procedures; practice in PI and injected structures; practice in appendicular IAI, injected joints and indication for the procedure; axial IAI practice and injected joints; CS used in PI and reason for choice; CS used in IAI and reason for choice; practice in PI and IAI image-guided injections and image technique used to guide the procedure; practice in viscosupplementation, joint lavage, epidural injection with CS and synovial, salivary gland, bone and muscle biopsies.

The questions that addressed the joints injected (PI or appendicular IAI) were analyzed not only descriptively, but also categorized as easy or difficult to perform according to the opinion of two (2) rheumatologists with extensive experience in interventional rheumatology as follows:

PI: Easy to perform: subacromial, lateral epicondyle, medial epicondyle, trochanteric bursa, ischial bursa, anserine bursa and plantar fascia; Difficult to perform: peritendon of short extensor/long abductor of the thumb (de Quervain tendinitis), carpal tunnel, peritendon of flexor tendon of finger (stenosing tendonitis or trigger tendonitis), Baker cyst, perienthesites/bursitis of the Achilles tendon, in synovial sheath of the peroneal tendons and the posterior tibial tendon.

IAI: Easy to perform: knee; wrist; ankle and metacarpophalangeal; Difficult to perform: temporomandibular; acromioclavicular; glenohumeral; radiohumeral; 1st metacarpophalangeal, proximal interphalangeal and distal interphalangeal; hip; subtalar; intertarsal and metatarsophalangeal.

Participants were initially divided into two groups: “non-interventional group”, formed by Rheumatologists who do not perform any procedure, and “interventional group”, formed by Rheumatologists who did at least one type of procedure. Later, they were then divided into two groups: (1) “many interventions group” who did at least 50% of PIs considered easy, 20% of PIs considered difficult, 50% of IAIs considered easy and 20% of IAIs considered difficult; (2) “few interventions group” who did some invasive procedures, but did not reach the pre-set limit to compose the first subgroup, as well as rheumatologists who did not perform any type of procedure.

Regarding the question on the most effective CS for intra-articular use, according to scientific evidence, the best option was considered triamcinolone hexacetonide.¹⁴

Table 1 – Demographic characteristics of the sample.

	Sample
Total sample	463
Age (years) – mean (SD)	40.2 (11.2)
Adult Rheumatologists – n (%)	444 (95.9)
Practitioners of invasive procedures – n (%)	365 (78.8)
Graduation in public university – n (%)	294 (64.6)
Specialist in Rheumatology – n (%)	296 (64)
Master degree – n (%)	105 (23.1)
PhD degree – n (%)	56 (12.4)
Actual University link – n (%)	185 (42.2)
Private practice – n (%)	321 (72.6)
Received training in invasive procedures – n (%)	371 (81.5)
Received training lasting more than six months – n (%)	206 (57.9)
Performed PI – n (%)	323 (69.9)
Performed IAI – n (%)	358 (78)
Performed axial IAI – n (%)	50 (10.9)
Right choice of CE for PI – n (%)	245 (72.3)
Right choice of CE for IAI – n (%)	163 (43.7)
Graduate decade	
Time since graduation (years) – mean (SD)	15.6 (11.1)
Before 1980 – n (%)	49 (10.7)
Between 1980 and 1989 – n (%)	86 (18.8)
Between 1990 and 1999 – n (%)	93 (20.3)
Between 2000 and 2009 – n (%)	230 (50.2)
Specialist title	
Time since obtaining the title (years) – mean (SD)	12.7 (10.1)
Before 1980 – n (%)	8 (2.9)
Between 1980 and 1989 – n (%)	43 (15.5)
Between 1990 and 1999 – n (%)	72 (25.9)
Between 2000 and 2009 – n (%)	95 (34.2)
After 2010 (%)	60 (21.6)
SD, standard deviation; PI, periarticular injection; IAI, intra-articular injection.	

Regarding more complex procedures in interventional rheumatology (guided procedures, biopsies, joint lavage and epidural injection with CS), Rheumatologists had to describe their competence to perform it, and where they obtained technical training.

Statistical analysis

Descriptive analysis (mean, standard deviation [SD], frequency and percentage) was used for the characterization of the sample.

After the competence description of Brazilian rheumatologists in interventional rheumatology, the following analyzes were performed: assessment of the association between competence and demographic variables and training variables and comparing the “non-interventional”/“interventional” groups and “many interventions”/“few interventions” groups. Moreover, an analysis was carried out to identify predictor factors of participants belonging to the “many interventions” group.

Age, origin and place of training were compared. For these comparisons, the Mann-Whitney test was used for continuous variables. Categorical variables were analyzed using Pearson’s Chi-square test.

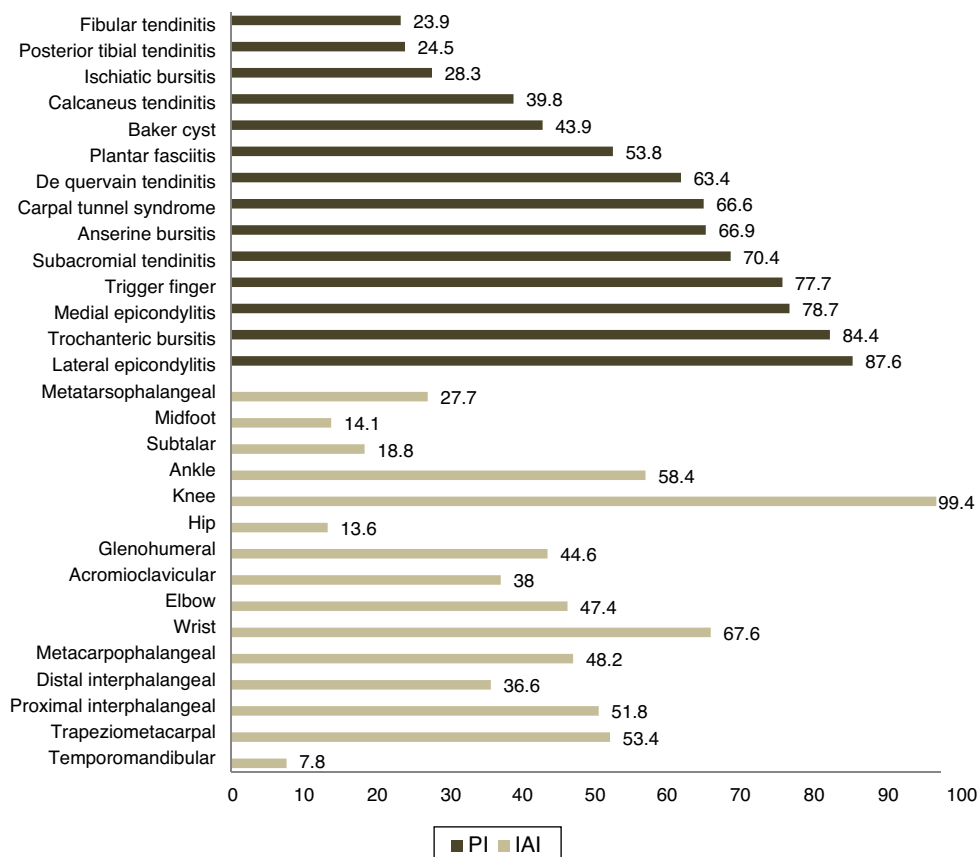


Fig. 1 – Percentage of participants who perform periarticular injection (PI) and intra-articular injection (IAI) per joint or structure.

The multivariate logistic regression using backward conditional method was also performed to identify factors that could predict the participant's probability of belonging to the "many interventions" group.

The SPSS software version 17.0 (Chicago, IL) was used and the level of statistical significance was 5%.

Results

Four hundred eighty-seven questionnaires were completed, of which 463 met the inclusion criteria. Twenty-four participants were excluded because they were not rheumatologists.

The demographic characteristics of the sample are shown in Table 1. Majority of participants (81.5%) declared to have received training in interventional rheumatology during residency/specialization. Approximately 70% performed PI, while 78% performed IAI. The southeast region of Brazil was the one that obtained the highest number of participants in the study – graduated (58.3%), trained in rheumatology (77.2%), holding master's (74.8%) or PhD (78.8%) degrees and currently working in private practice (62.8%).

Fig. 1 shows the frequency of PIs and IAIs. Lateral epicondylitis, trochanteric bursitis and medial epicondylitis were the periarticular diseases most injected. The appendicular

joints most injected were the knee, wrist and ankle. The indications for IAI were the presence of synovitis (91.2%), followed by joint swelling (64.9%) and joint pain (27.3%). Joint instability was identified as an indication for IAI in only 1.7% of participants. Fifty (10.9%) participants performed axial IAI. The axial joint most injected was the sternoclavicular, being injected by 76.6% of participants.

Fig. 2 shows the CSs commonly used in IAIs and PIs. For both types of injections (IAIs and PIs), the presence of scientific evidence has been the main reason for choosing the CS, being indicated by 53.8% of the participants to PI and 67.5% for IAI. Most rheumatologists (67.3%) indicated correctly that triamcinolone hexacetonide was as the most effective CS for IAIs.

Guided IAIs were performed by only 14% of participants, with the ankle (75.8%), hip (54.8%) and glenohumeral (53.2%) being the most guided injected joints. The most widely used method to guide the IAI was ultrasonography, which was used by 88.7%.

Regarding the practice of viscosupplementation, it was observed that 38.2% of rheumatologists reported having done this procedure in their medical practice. The most submitted joint to viscosupplementation was the knee (100% of cases).

Joint lavage is the most performed invasive procedure, which was performed by 10.6% of rheumatologists. The least performed one was bone biopsy (1.3%). For the least common

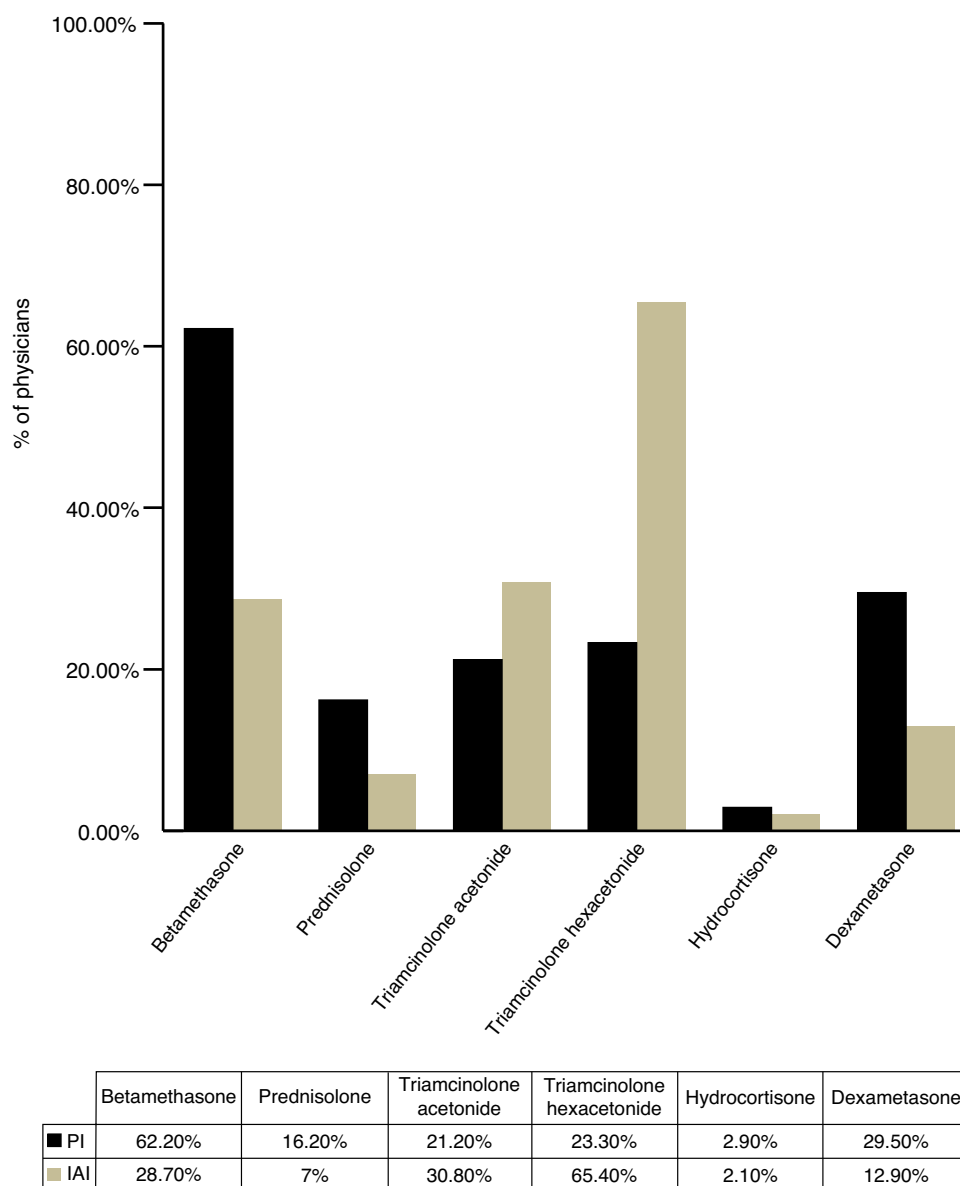


Fig. 2 – Corticosteroid choice for periarticular injections (PI) and intra-articular injection (IAI).

invasive procedures, residency was the venue where most participants received academic training.

Table 2 shows the comparison of demographic data and academic training between the “non-interventional” and “interventional” groups. It was observed that the average age of the “non-interventional” group was significantly higher than the “interventional” group. In the “interventional” group, there was a higher proportion of rheumatologists connected with university and trained in interventional rheumatology for more than six months during residency/medical specialization. The “non-interventional” group had a significantly higher proportion of individuals with training in rheumatology in the southeastern region of Brazil and graduated between 1980 and 1989. The “interventional” group had rheumatologists with a higher proportion of training in rheumatology in the southern region of Brazil.

Table 3 shows the comparison of demographic data, academic training and practice of more complex invasive procedures among the “many interventions” and “few interventions” groups. It was observed that the “many interventions” group had a higher proportion of rheumatologists seeing only adult patients, connected with university, and trained in interventional rheumatology for more than six months in residency/specialization in rheumatology, with practice in axial IAI, image-guided injection, viscosupplementation practice, joint lavage, synovial biopsy, salivary gland biopsy and epidural injection with CS practice. We also found that the “few interventions” group had a higher proportion of participants working in private practice, with a medical degree and rheumatology training in the southeastern region of Brazil, while the “many interventions” group had a higher proportion of rheumatologists working in private practice,

Table 2 – Comparison between the “interventional” and “non-interventional” groups.

	Interventional group (n = 356)	Non-interventional group (n = 94)	p
Age (years) – mean (SD)	39.7 (11.2)	42 (10.9)	0.04
Adult rheumatologist – n (%)	353 (96.7)	91 (92.9)	0.088
Graduate in public university – n (%)	237 (66.2)	57 (58.8)	0.365
Time since graduation (years) – mean (SD)	15.3 (11.1)	17 (10.7)	0.122
Specialist title – n (%)	230 (63.7)	63 (64.9)	0.822
Time since receiving specialist title (years) – mean (SD)	12.3 (10.1)	13.9 (9.9)	0.210
Master degree – n (%)	79 (22.1)	26 (27.1)	0.301
PhD degree – n (%)	45 (12.6)	11 (11.3)	0.730
University link – n (%)	159 (45.8)	26 (28.6)	0.003
Private practice – n (%)	256 (73.4)	65 (69.9)	0.506
Interventional rheumatology training – n (%)	325 (90.3)	46 (48.4)	<0.001
Interventional rheumatology training > 6 months – n (%)	191 (61.6)	15 (32.6)	<0.001
Graduation region (n = 458)	(n = 361)	(n = 97)	
Southeast – n (%)	202 (56)	65 (67)	0.167
Northeast – n (%)	56 (15.5)	15 (15.5)	
North – n (%)	10 (2.8)	3 (3.1)	
South – n (%)	67 (18.6)	8 (8.2)	
Midwest – n (%)	19 (5.3)	3 (3.1)	
Rheumatology graduation region (n = 439)	(n = 354)	(n = 85)	
Southeast – n (%)	262 (74)	77 (90.6) ^a	0.046
Northeast – n (%)	15 (4.2)	1 (1.2)	
North – n (%)	1 (0.3)	0 ^a	
South – n (%)	51 (14.4)	4 (4.7)	
Midwest – n (%)	21 (5.9)	3 (3.5)	
Private practice region (n = 308)	(n = 247)	(n = 61)	
Southeast – n (%)	149 (60.3)	43 (70.5) ^a	0.414
Northeast – n (%)	37 (15)	8 (13.1)	
North – n (%)	2 (0.8)	1 (1.6)	
South – n (%)	43 (17.4)	5 (8.2) ^a	
Midwest – n (%)	16 (6.5)	4 (6.6)	
Graduate decade (n = 458)	(n = 361)	(n = 97)	
Before 1980 – n (%)	41 (11.4)	8 (8.2)	0.035
Between 1980 and 1989 – n (%)	58 (16.1)	28 (28.9) ^a	
Between 1990 and 1999 – n (%)	77 (21.3)	16 (16.5)	
Between 2000 and 2009 – n (%)	185 (51.2)	45 (46.4)	

SD, standard deviation.

Mann-Whitney test was used for categorical data; chi-square test was used for numerical data.

^a Statistical difference when compared to “interventional” group.

with a medical degree and rheumatology training in the southern region of Brazil.

Using the backward conditional method, a multivariate logistic regression was performed to identify and calculate the odds ratio (OR) of variables that were most associated to the “many interventions” group. The variables found were the following: practice in axial IAI, viscosupplementation, joint lavage, synovial biopsy, salivary gland biopsy, IAI guided by image and training in interventional rheumatology for longer than six months.

The most strongly associated variable was axial IAI practice, with an OR of 7.4 (95% CI 2.7–20.1, $p < 0.001$), followed by synovial biopsy (OR of 5.7 [95% CI, 1.05–31.32] $p < 0.05$) and image-guided injections (OR of 4.1 [IC 95%, from 1.88 to 9.2] $p < 0.0010$). The data for these and other variables

identified by multivariate logistic regression are shown in [Table 4](#).

Discussion

In Brazil, the vast majority of rheumatologists have some kind of specific training in interventional rheumatology during medical residency or specialization. In the present study, most Brazilian rheumatologists assessed performed procedures in rheumatology, with IAI being more common than PAI. Performing more complex invasive procedures, viscosupplementation, and over 6-month training in interventional rheumatology were variables associated with a more interventional profile.

Table 3 – Comparison between “many interventions” and “few interventions” groups.

	“Many interventions” group (n = 356)	“Few interventions” group (n = 94)	p
Age (years) – mean (SD)	39.5 (10.9)	40.5 (11.4)	0.360
Adult rheumatologist – n (%)	162 (100%)	282 (93.7)	0.001
Graduate in public university – n (%)	114 (71.7)	180 (60.8)	0.068
Time since graduation (years) – mean (SD)	15 (10.9)	16 (11.1)	0.313
Specialist title – n (%)	108 (68.4)	185 (61.7)	0.156
Time since receiving specialist title (years) – mean (SD)	12.8 (9.5)	12.5 (10.4)	0.609
Master degree – n (%)	39 (24.5)	66 (22.4)	0.603
PhD degree – n (%)	25 (15.9)	31 (10.5)	0.093
University link – n (%)	78 (49.7)	107 (38.1)	0.018
Private practice – n (%)	121 (77.1)	200 (70.2)	0.120
Interventional rheumatology training – n (%)	104 (72.7)	102 (47.9)	<0.001
Axial IAI practice – n (%)	40 (24.7)	10 (3.4)	<0.001
Imaging-guided IAI practice – n (%)	45 (28)	19 (6.4)	<0.001
Viscosupplementation practice – n (%)	89 (57.1)	67 (26.6)	<0.001
Joint lavage practice – n (%)	32 (20)	16 (5.5)	<0.001
Synovial biopsy practice – n (%)	21 (13)	5 (1.7)	<0.001
Salivary gland biopsy practice – n (%)	19 (11.7)	10 (3.3)	<0.001
Bone biopsy practice – n (%)	2 (1.2)	4 (1.3)	0.929
Muscle biopsy practice – n (%)	10 (6.2)	8 (2.7)	0.063
Epidural injection practice – n (%)	19 (11.8)	6 (2)	<0.001
Graduation region (n = 458)	(n = 160)	(n = 298)	
Southeast – n (%)	80 (50)	187 (62.8) ^a	<0.001
Northeast – n (%)	19 (11.9)	52 (17.4)	
North – n (%)	5 (3.1)	8 (2.7)	
South – n (%)	43 (26.9)	32 (10.7) ^a	
Midwest – n (%)	10 (6.3)	12 (4)	
Rheumatology specialization region (n = 439)	(n = 158)	(n = 281)	
Southeast – n (%)	108 (68.4)	231 (82.2) ^a	<0.001
Northeast – n (%)	5 (3.2)	11 (3.9)	
North – n (%)	–	1 (0.4)	
South – n (%)	33 (20.9)	22 (7.8) ^a	
Midwest – n (%)	9 (5.7)	15 (5.3)	
Private practice region (n = 308)	(n = 116)	(n = 192)	
Southeast – n (%)	63 (54.3)	129 (67.2) ^a	0.007
Northeast – n (%)	13 (11.2)	32 (16.7)	
North – n (%)	2 (1.7)	1 (0.5)	
South – n (%)	27 (23.3)	21 (10.9) ^a	
Midwest – n (%)	11 (9.5)	9 (4.7)	
Graduate decade (n = 458)	(n = 160)	(n = 298)	
Before 1980 – n (%)	15 (9.4)	34 (11.4)	0.858
Between 1980 and 1989 – n (%)	29 (18.1)	57 (19.1)	
Between 1990 and 1999 – n (%)	35 (21.9)	58 (19.5)	
Between 2000 and 2009 – n (%)	81 (50.6)	149 (50)	

SD, standard deviation.

Mann-Whitney test was used for categorical data; chi-square test was used for numerical data.

^a Statistical difference when compared to “interventional” group.

According to the Brazilian Ministry of Education and Culture (MEC), arthrocentesis, IAI and PI are skills that must be acquired throughout residency in rheumatology, as part of the official program of the specialty training. Procedures such as biopsies (bone, skin, minor salivary gland, muscle and subcutaneous), MU, nerve regional blocking and epidural injection are considered optional, even if recommended.¹⁵ Despite the existence of this theoretical program, it is known that heterogeneity among programs is huge.

We believe that the questionnaire used in this study has covered most variables related to the practice of Brazilian Rheumatologists in interventional rheumatology. At the time the data were collected, we did not find in the literature any other similar study involving Brazilian rheumatologists. There were, however, studies assessing the practice and education of the rheumatologist in MU and the practice and training in IAI and PI of general practitioners.^{7,8}

Table 4 – Multivariate logistic regression for prediction of belonging to the “many interventions” group.

	p	OR (95% CI)
Axial IAI practice	<0.001	7.422 (2.740–20.105)
Synovial biopsy practice	0.043	5.758 (1.059–31.321)
Imaging-guided IAI practice	<0.001	4.169 (1.888–9.204)
Salivary gland biopsy practice	0.034	3.445 (1.098–10.810)
Viscosupplementation practice	<0.001	3417 (1.928–6.056)
Joint lavage practice	0.019	3221 (1.213–8.550)
Interventional rheumatology training > 6 months – n (%)	0.008	2164 (1.219–3.841)

OR, odds ratio; CI, confidence interval.

Studies published by Gormley et al. (2003) and Liddell et al. (2005) addressed the practice of IAI and PI among United Kingdom general practitioners. Both studies reported shoulder, knee and lateral epicondylitis injections as the most commonly performed. Among the factors, those that influenced the expertise in IAI and PI were male gender, practice in rural region and formal training in those procedures.^{7,8}

Our sample consisted of 463 participants with a mean age of 40.2 years and the vast majority (95.9%) was composed by rheumatologists seeing only adult patients. The percentage of appendicular IAI practitioners (78%) was higher than PI practitioners (69.9%), and a much smaller percentage reported performing axial IAI (10.9%).

Among the PIs, the most injected was lateral epicondyle (87.6%), in which was similar to studies conducted by Gormley in 2003 and Liddell in 2005. Among the joints most commonly injected, the knee stood out with 99.4%. This fact is probably due to the wide variety of rheumatic and orthopedic diseases that affect this joint. In addition, it is the largest joint of the locomotor system and it is relatively superficial, which favors the possibility of performing safe procedures blindly.

Among the most commonly CS used in PIs, the most used in this study was betamethasone (62.2%). However, it was observed that 23.3% of participants reported using triamcinolone hexacetonide for this procedure, which is a potentially dangerous practice for the patient due to its atrophying characteristic.¹⁴

For the IAI, the most used CS was triamcinolone hexacetonide (65.4%), also considered the most effective (67.3%). Comparing these data with those found by Centeno and colleagues in 1994, we observed that among American rheumatologists, methylprednisolone was the most used CS for knee IAI, while in Brazil the most used was triamcinolone hexacetonide.⁶ However, triamcinolone hexacetonide was considered the effective CS by both American and Brazilian rheumatologists.

Regarding the performance of image-guided joint injections, we found that 14% of participants in this study performed this procedure, especially in the ankle, hip and glenohumeral joint. The MU was the most used method to guide joint injections. We observed that 11.9% of the assessed rheumatologists used joint injections guided by MU. This result is similar to two studies showing that in most EULAR countries (84.9% of the countries) less than 10% of rheumatologists performed this procedure.¹¹ In Japan, 10.8% did it.¹³ Countries such as of the United Kingdom and the United

States have a higher percentage of rheumatologists practicing MU, 33% and 21%, respectively.^{9,12}

In our sample, few rheumatologists were skilled for the practice of the most invasive and complex procedures (joint lavage; synovial, salivary gland, bone and muscular biopsies; and epidural injection). Their training occurred in rheumatology residency.

When compared to the “interventional” group, the “non-interventional” group had a lower proportion of university link and shorter training (less than six months) duration in interventional rheumatology. These findings once again corroborate the great importance of proper training in intervention rheumatology. In the “interventional” group, a higher proportion of graduates in the southern region of Brazil was found. Interestingly, the Southeast region of Brazil showed the highest proportion of participants in the “few interventions” group. This was a surprising finding due to the higher concentration of rheumatologists in the southeast Brazilian region.

Interestingly, in studies conducted by Gormley and Liddell, it was also found that general practitioners working in areas with low concentration of experts, cited in the study as rural or mixed region, were more likely to perform locomotor system injections.^{7,8} We also found that the “no intervention” group had a higher proportion of graduates in the decade from 1980 to 1989 compared to the “interventional” group. The latter result can infer that physicians graduated after 1990 or younger physicians are more interventional, currently. However, there was no significant difference between groups in the numbers of years (mean – DP) after graduation.

Regarding the comparison between “many interventions” and “few interventions” groups, it was found that the “many interventions” group had a higher proportion of adult rheumatologists, university-related professionals and those with training time in interventional rheumatology greater than 6 months. The “many interventions” group also had a higher proportion of axial IAI practitioners, as well as those performing image-guided injections, viscosupplementation and more complex invasive procedures. These findings are most likely related to longer training, and also reveal the most interventional profile of this group.

When we conducted multivariate logistic regression for prediction of belonging to the “many interventions” group, we found that the variable most associated with this group was the practice in more complex invasive procedures. According to logistic regression, the only predictor variable of belonging to the “many interventions” group was “training

time in interventional rheumatology greater than 6 months”, which once again reaffirms the need for formal and adequate training, especially during the residency in interventional rheumatology, for greater employability of various types of diagnostic or therapeutic procedures, including those considered more complex in the practice of rheumatology. This finding is similar to those of Gormley et al. (2003), who similarly found that physicians who have received formal training were more likely to carry out joint injection.⁷

The absence of the variable “gender” between covered demographics could be considered a limitation of this study. Other limitations are the fact that the questionnaire was self-administered and would have enabled more easily to provide inappropriate information. The study population was recruited at an event held in the southeast region of Brazil. This may have increased the percentage of participants in this region at the expense of others.

The great practical applicability of this study is that it reaffirms the importance of systematic training in interventional rheumatology for prolonged periods during the formative years of the rheumatologist, preferably during medical residency.

Conclusion

In conclusion, this study identified that the variables related to a more interventional profile among Brazilian rheumatologists were the following: working with adults patients and in university; did graduation and having a private clinic in the southern region of Brazil; and, mainly, having had an interventional rheumatology training time longer than six months and in more complex osteoarticular procedures.

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Hollander JL, Brown EM Jr, Jessar RA, Brown CY. Hydrocortisone and cortisone injected into arthritic joints; comparative effects of and use of hydrocortisone as a local antiarthritic agent. *J Am Med Assoc.* 1951;147:1629-35.
2. Vordenbaumen S, Joosten LA, Friemann J, Schneider M, Ostendorf B. Utility of synovial biopsy. *Arthritis Res Ther.* 2009;11:256.
3. Ralston SH. Bone densitometry and bone biopsy. *Best Pract Res Clin Rheumatol.* 2005;19:487-501.
4. Harris BT, Mohila CA. Essential muscle pathology for the rheumatologist. *Rheum Dis Clin North Am.* 2011;37:289-308, vii.
5. Chisholm DM, Mason DK. Labial salivary gland biopsy in Sjögren's disease. *J Clin Pathol.* 1968;21:656-60.
6. Centeno LM, Moore ME. Preferred intraarticular corticosteroids and associated practice: a survey of members of the American College of Rheumatology. *Arthritis Care Res.* 1994;7:151-5.
7. Gormley GJ, Corrigan M, Steele WK, Stevenson M, Taggart AJ. Joint and soft tissue injections in the community: questionnaire survey of general practitioners' experiences and attitudes. *Ann Rheum Dis.* 2003;62:61-4.
8. Liddell WG, Carmichael CR, McHugh NJ. Joint and soft tissue injections: a survey of general practitioners. *Rheumatology (Oxford).* 2005;44:1043-6.
9. Cunnington J, Platt P, Raftery G, Kane D. Attitudes of United Kingdom rheumatologists to musculoskeletal ultrasound practice and training. *Ann Rheum Dis.* 2007;66:1381-3.
10. Duftner C, Schuller-Weidekamm C, Mandl P, Nothnagl T, Schirmer M, Kainberger F, et al. Clinical implementation of musculoskeletal ultrasound in rheumatology in Austria. *Rheumatol Int.* 2014;34:1111-5.
11. Mandl P, Naredo E, Conaghan PG, D'Agostino M-A, Wakefield RJ, Bachtá A, et al. Practice of ultrasound-guided arthrocentesis and joint injection, including training and implementation in Europe: results of a survey of experts and scientific societies. *Rheumatology (Oxford).* 2012;51:184-90.
12. Samuels J, Abramson SB, Kaeley GS. The use of musculoskeletal ultrasound by rheumatologists in the United States. *Bull NYU Hosp Jt Dis.* 2010;68:292-8.
13. Takase K, Ohno S, Ideguchi H, Takeno M, Shirai A, Ishigatsubo Y. Use of musculoskeletal ultrasound in Japan: a survey of practicing rheumatologists. *Mod Rheumatol.* 2010;20:376-80.
14. Furtado R, Natour J. Infiltrações no aparelho locomotor. *Porto Alegre: Artmed;* 2011. p. 180.
15. Giorgi RDN, Laurindo IMM. Requisitos mínimos do programa de residência médica em reumatologia (R1 e R2). São Paulo: Sociedade brasileira de reumatologia; 2010. Available from: http://portal.mec.gov.br/index.php?option=com_docman&task=doc.download&gid=6538&Itemid= [cited 10.07.15].