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Brazilian infectious diseases specialists: who and where are they?

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ABSTRACT

Background: The infectious diseases specialist is a medical doctor dedicated to the management of infectious diseases in their individual and collective dimensions.
Objectives: The aim of this paper was to evaluate the current profile and distribution of infectious diseases specialists in Brazil.
Methods: This is a cross-sectional study using secondary data obtained from institutions that register medical specialists in Brazil. Variables of interest included gender, age, type of medical school (public or private) the specialist graduated from, time since finishing residency training in infectious diseases, and the interval between M.D. graduation and residency completion. Maps are used to study the geographical distribution of infectious diseases specialists.
Results: A total of 3229 infectious diseases specialist registries were counted, with 94.3% (3045) of individual counts (heads) represented by primary registries. The mean age was 43.3 years (SD 10.5), and a higher proportion of females was observed (57%; 95% CI 55.3–58.8). Most Brazilian infectious diseases specialists (58.5%) practice in the Southeastern region. However, when distribution rates were calculated, several states exhibited high concentration of infectious diseases specialists, when compared to the national rate (16.06). Interestingly, among specialists working in the Northeastern region, those trained locally had completed their residency programs more recently (8.7 yrs; 95% CI 7.9–9.5) than physicians trained elsewhere in the country (13.6 yrs: 95% CI 11.8–15.5).
Conclusion: Our study shows that Brazilian infectious diseases specialists are predominantly young and female doctors. Most have concluded a medical residency training program.

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The absolute majority practice in the Southeastern region. However, some states from the Northern, Northeastern and Southeastern regions exhibit specialist rates above the national average. In these areas, nonetheless, there is a strong concentration of infectious diseases specialists in state capitals and in metropolitan areas.

Introduction

The infectious diseases specialty is a medical professional field dedicated to the management of disease in both individual and collective dimensions. The infectious diseases specialist (ID) must thus have comprehensive medical knowledge and skills to be able to integrate individual clinical data with concepts that emerge from other biomedical areas that include epidemiology, microbiology, immunology, and public health. To provide comprehensive care to patients suffering with bacterial, viral, fungal, or parasitic infections, an ID should not only be able to diagnose and treat the patient properly, but also to participate in the surveillance and prevention of communicable diseases spread. Moreover, IDs may also play an expert role in assessing the ecological and economic impact of infectious diseases on health systems and the community. Currently, Brazilian IDs require versatile attributes in order to face patient care related to endemic neglected tropical diseases, HIV/AIDS, and viral hepatitis, as well as novel health challenges, such as emerging and reemerging diseases (H_1N_1 influenza, chikungunya, and Zika viral infections), multiresistant bacterial infections and hospital infection control, infections in migrants, travelers and in immunocompromised patients.[1–3]

Brazilian ID training started with the implementation of a specialized medical residency program in 1952 at Hospital das Clinicas, affiliated to the University of São Paulo Faculty of Medicine.[4,5] Since then, new programs were launched in other regions, before national regulations were established in 1977 under the Federal Decree number 80,281,[6] which created the Comissão Nacional de Residência Médica – CNMR (National Medical Residency Committee), affiliated to the Ministry of Education. In 1981, Federal Law number 6,932[7,8] was passed and conceptualized residency training as the recommended "post-graduation program for medical doctors, based on in-service training under the supervision of ethical and highly skilled medical professionals". Finally, minimum curricula requirements for these training programs were approved and implemented nationwide in 1983.[9]

Currently, certification of ID in Brazil is obtained after completing a 3-year infectious disease residency training (IDRT) at a CNRM-accredited institution.[10,11] MR programs include learning activities in several practice scenarios, such as outpatient clinics, hospital inpatient wards, intensive care units and field work, covering aspects related to internal medicine and infectious diseases. Each program may place special emphasis on diseases that are more prevalent in its location.[12] Alternatively, ID may be certified after approval in a board examination, prepared by the Sociedade Brasileira de Infectologia – SBI (Brazilian Society of Infectious Diseases) and accredited by the Associação Médica Brasileira – AMB (Brazilian Medical Association).[10,11,13]

Infectious disease specialists have an important role to play in medical care provision in Brazil. It is broadly recognized that the country has experienced an irregular epidemiological transition.[14,15] Although infectious diseases-related deaths have been remarkably reduced over the past six decades, these illnesses still remain relevant public health issues. Despite having successfully controlled vaccine-preventable diseases, cholera, and vector-borne Chagas' disease, some illnesses remain for which control has failed (i.e., dengue and visceral leishmaniasis) or been partially effective (i.e., HIV/AIDS, viral hepatitis, leprosy, tuberculosis, and schistosomiasis), due to complex transmission patterns associated with adverse environmental, social, economic, or unknown determinants. Moreover, some of these diseases are chronic, exhibit long infective periods and require prolonged treatment, or sometimes are transmitted by insect vectors that are difficult to control.[16]

When planning healthcare strategies for the Brazilian population, a clear understanding of how specialized healthcare personnel is prepared to face these challenges and to what extent these professionals are available throughout the country is certainly useful. The aim of this paper is thus to evaluate the current profile and distribution of IDs in Brazil.

Material and methods

This is a cross-sectional study using secondary data. Evaluated datasets included administrative registry and notary data obtained after linkage of three primary sources: Conselho Federal de Medicina – CFM (Federal Medical Council) database that integrated information from 27 Conselhos Regionais de Medicina – CRMs (Regional Medical Councils), including one database from each Brazilian state; the database of the Comissão Nacional de Residência Médica – CNMR (National Medical Residency Committee), affiliated to the Ministry of Education; and the Associação Médica Brasileira – AMB (Brazilian Medical Association) dataset that integrated databases from medical specialty societies (BSID, in this case). All databases were accessed in May 2014.

An ID was defined as a physician who completed IDRT in a CNRM-accredited program or who had passed the BSID board examination.[10,11]

Qualitative variables of interest for our study included gender, age, type of medical school the ID graduated from (public or private), time since completion of IDRT, interval between

medical graduation and IDRT completion, and the Brazilian region where the IDRT took place. Time since completion of the IDRT was also evaluated quantitatively.

Relative distribution of IDs was computed as follows: (number of ID/total population) × 1,000,000 inhabitants.

ID distribution was assessed in two ways: state affiliation according to the corresponding state CRM registry and municipal affiliation based on the mailing address provided by the physician to the CRM. The Brazilian region where the physician completed his/her medical residency program was used as a stratifying variable.

Population data were obtained from Instituto Brasileiro de Geografia e Estatística – IBGE (Brazilian Institute of Geography and Statistics).[17] Comparison between the profile and distribution of IDs and other specialist physicians (OS) was possible due to access to the Brazilian Medical Demography study database.[18]

Proportions and 95% confidence intervals (95% CI) were used as descriptive statistics. Selected variables were then studied in conjunction with CIs estimated in 1000 bootstrapped samples.[19] A computational software, Statistical Package for the Social Sciences – SPSS 20 for Windows

Table 1 – Descriptive statistics of Brazilian infectious diseases specialists, 2015.

	ID (*n*)	ID (%)	95% CI		OS Percent
			Lower	Upper	
Gender					
Female	1737	57.0	55.3	58.8	40.5
Male	1308	43.0	41.2	44.7	59.9
Total	3045	100			
Age (years)					
≤29	126	4.1	3.4	4.8	2.4
30–34	631	20.7	19.1	22.2	14.8
35–39	607	19.9	18.5	21.4	15.5
40–44	444	14.6	13.3	15.9	13.1
45–49	357	11.7	10.6	12.9	12.7
50–54	365	12.0	10.8	13.2	11.5
55–59	271	8.9	8.0	9.9	11.1
60–64	137	4.5	3.8	5.2	9.6
65–69	63	2.1	1.6	2.6	4.9
≥70	44	1.4	1.1	1.9	4.4
Total	3045	100			
Type of medical school IDs graduated from[a]					
Public	2017	71.6	70.0	73.3	
Private	799	28.4	26.7	30.0	
Total	2816	100			
Medical residency training in ID					
No	579	19.0	17.7	20.3	
Yes	2466	81.0	79.7	82.3	
Total	3045	100			
Interval between M.D. graduation and completion of residency training (years)					
≤3	555	22.5	22.5	26.1	
4–10	1629	66.1	69.3	73.3	
≥10	282	11.4	7.6	15.3	
Total	2466	100			
Brazilian Region where residency training was completed					
Northern	128	5.2	4.4	6.0	
Northeastern	301	12.2	10.9	13.5	
Southeastern	1746	70.8	68.9	72.5	
Southern	174	7.1	6.0	8.1	
Center-western	117	4.7	3.9	5.6	
Total	2466	100			
Time since completion of residency training (years)					
<2	395	16.0	14.7	17.6	
2–5	438	17.8	16.2	19.2	
5–10	569	23.1	21.3	24.7	
≥10	1064	43.1	41.1	45.1	
Total	2466	100			

M.D.G., MD graduation; OS, other specialist medical doctors; ID, infectious diseases specialists; 95% CI, 95% confidence interval.

[a] Missing data = 229.

Table 2 – Other medical specialties practiced by Brazilian infectious diseases specialists, 2015.

Specialties	*n*	%
Internal Medicine	339	34.1
Pediatrics	260	26.1
Intensive care	74	7.4
Occupational medicine	63	6.3
Preventive and social medicine	28	2.8
Family and community medicine	26	2.6
Acupuncture	25	2.5
Dermatology	23	2.3
Pathology	15	1.5
Cardiology	14	1.4
Laboratory medicine	13	1.3
Traffic medicine	11	1.1
Pneumology	11	1.1
General surgery	9	0.9
Others[a]	84	8.4
Total	995	100.0

[a] Including 25 specialties practiced by infectious diseases specialists.

(International Business Machines Corp., New York, USA), was used for statistical analysis.

Mailing addresses were used to generate the dot density map. The municipality was adopted as the geographic unit of analysis, and one dot represents one ID. The state was used as the unit of analysis for the color map, with darker tones representing higher ID densities. Maps were generated using Quantum GIS (version 1.7.4; QGIS Development Team – http://www.qgis.org/en/site/).

Results

A total of 3229 ID registries were analyzed, with 94.3% (3045) of the individual counts (head) obtained from primary registries and 5.7% (184) from secondary registries. Individual data are evaluated based on the number of heads and geographical distribution with the total number of registries.

Descriptive analyses of the ID profile are provided in Table 1. The gender distribution of IDs was heterogeneous, with a higher proportion of females in the sample. The mean age was 43.3 years (SD 10.5); with predominance of the younger categories, especially ages between 30–34 and 35–39. These features were significantly different from the distribution of other medical specialists (OS).

We also observed that 71.6% of IDs had graduated in Medicine from public higher education institutions, and that 81% of them had concluded a medical residency program in the field. Over 70% completed their ID residency training in the Southeast region of Brazil, and 43.1% had concluded it more than 10 years before (Table 1). Table 2 shows other medical specialties simultaneously practiced by IDs.

The absolute distribution of IDs, according to the Brazilian administrative regions and states is evaluated in Tables 3 and 4. The Southeastern region showed the highest proportion of IDs (58.5%), followed by the Northeastern (16.1%) and Southern regions (10.7%). States with the lowest absolute number of IDs (less than 22 IDs) were Acre, Roraima, Amapá, Tocantins, and Maranhão. In contrast, São Paulo, Minas Gerais, Rio de Janeiro, Paraná, and Rio Grande do Sul had more than 143 IDs (Fig. 1 – Map 1). It is important to highlight that states with higher numbers of IDs also showed some dispersion of dots within the state (Fig. 1 – Map 2). In Table 4 we describe the relative distribution of IDs by state populations.

The overall mean time since completion of medical residency training (RCt) was 10.9 years (SD 8.5). Similar RCts were observed among IDs from the Southeastern region, regardless whether they had been trained locally (δ) or elsewhere in Brazil (†). In contrast, significant differences were noted in the Northeastern regions for δ – 8.7 years (95% CI 7.9–9.5) vs † – 13.6 years (95% CI 11.8–15.5), and less remarkably in the Northern region 8.4 years (95% CI 7.1–9.9) for δ vs 11.8 years (95% CI 9.6–14.3) for †(Table 5).

Discussion

The specialist physician is considered a very important professional for healthcare provision. Many studies have shown that specialists are more knowledgeable than general practitioners concerning the proper use of diagnostic techniques and efficacious therapies to provide care deemed appropriate.[20–25]

Currently, Brazil has a total of 405,744 physicians (head).[26] Out of this total, medical specialties account for 207,879 physicians.[18] Thus, we can infer that the number of infectious diseases specialists is low, as compared to the number

Table 3 – Distribution of infectious diseases specialists and other specialist medical doctors according to Brazilian regions, 2015.

Region	ID (*n*)	ID (%)	95% CI		OS (%)[16]
			Lower	Upper	
Northern	208	6.4	5.5	7.2	3.5
Northeastern	522	16.2	14.9	17.5	15.4
Southeastern	1891	58.5	56.8	60.4	54.4
Southern	348	10.8	9.7	11.9	18.2
Center-western	260	8.1	7.0	9.0	8.5
Total	3229	100			100

ID, infectious diseases specialists; OS, other specialist medical doctors; 95% CI, 95% confidence interval.

Table 4 – Density of infectious diseases specialists according to Brazilian states, 2015.

State/region	n	Inhabitants[17]	ID density[a]
Rondônia	22	1,728,214	12.73
Acre	19	776,463	24.47
Amazonas	65	3,807,921	17.07
Roraima	14	488,072	28.68
Para	75	7,969,654	9.41
Amapá	3	734,996	4.08
Tocantins	10	1,478,164	6.77
Northern	208	16,983,484	12.25
Maranhão	18	6,794,301	2.65
Piauí	49	3,184,166	15.39
Ceara	70	8,778,576	7.97
Rio Grande do Norte	58	3,373,959	17.19
Paraíba	55	3,914,421	14.05
Pernambuco	80	9,208,550	8.69
Alagoas	38	3,300,935	11.51
Sergipe	35	2,195,662	15.94
Bahia	119	15,044,137	7.91
Northeastern	522	55,794,707	9.36
Minas Gerais	249	20,593,356	12.09
Espirito Santo	89	3,839,366	23.18
Rio De Janeiro	392	16,369,179	23.95
São Paulo	1161	43,663,669	26.59
Southeastern	1891	84,465,570	22.39
Paraná	134	10,997,465	12.18
Santa Catarina	74	6,634,254	11.15
Rio Grande do Sul	140	11,164,043	12.54
Southern	348	28,795,762	12.09
Mato Grosso do Sul	41	2,587,269	15.85
Mato Grosso	34	3,182,113	10.68
Goiás	94	6,434,048	14.61
Distrito Federal	91	2,789,761	32.62
Center-western	260	14,993,191	17.34
Brazil	3229	201,032,714	16.06

[a] Infectious diseases specialist density per million inhabitants.

of total physicians (0.75%) or to the total number of medical specialists (1.46%). In Brazil, specialties that congregate the largest number of physicians are pediatrics, gynecology and obstetrics, general surgery, internal medicine, anesthesiology, occupational medicine, and cardiology, which together account for 52.9% of all specialists. It is noteworthy that 28.8% (879) of all 3045 IDs also practiced another medical specialty (Table 2). In total, 995 specialties are practiced by these 879 IDs, as some referred up to four specialties. The most common simultaneously practiced specialties were internal medicine (34.1%) and pediatrics (26.1%). This could be due to the fact that, since 2003, one year of training in internal medicine is a required component of IDRT; and because pediatric infectious disease is a commonly sought subspecialty by both IDs and pediatricians.

Statistics concerning the worldwide ID distribution are scarce. In Europe, countries where the specialty seems to be more represented are Turkey (1433, head), Romania (400, head), and Hungary (350, head). In relative terms (IDs per million inhabitants), Iceland (47), Hungary (35) Sweden (34), Latvia (31), and Croatia (30) are the most representative.[27] In international comparative standards, Brazil has 16.6 ID per million inhabitants, similarly to Switzerland, Norway, and Romania; even though the epidemiological relevance of infectious diseases differs among these countries. In the United State of America (USA), a survey with physicians who prescribe antiretroviral therapy (PPAT) and their patients showed that 40% and 42% had been formally trained in infectious diseases.[25] In Brazil, a similar study conducted in São Paulo showed that 51.2% of PPAT were formally trained IDs; if IDs who were formally certified by the BSID were added, 67.2% of Brazilian PPAR fell into this category.[28]

Our study also highlights that the absolute and relative distributions of ID are heterogeneous among Brazilian regions. The Southeastern region concentrated more than half of all ID records (58.8%). Interestingly, when the ID distribution was compared with other specialist physicians (OS) frequencies, the Northern and Southern regions drew special attention: the proportion of IDs in the Amazon exceeded that of other specialists – 6.4% (95% CI 5.5–7.2%) vs OS 3.5%, but the opposite feature was seen in the Southern region – 10.8% of IDs (95% CI 9.7–11.9%) vs 18.1% of OS.

Brazilian states with the largest ID densities were Acre (24.4/1 million inhabitants), Roraima (28.6), Amazonas (17.0) [Northern region], Rio Grande do Norte (17.1) [Northeast], São Paulo (26.5), Rio De Janeiro (23.9), Espírito Santo (23.1) [Southeastern], and Distrito Federal (32.6) [Mid-Western region] (Table 4). This assessment allows us to identify two distinct clusters. The Southeastern region is recognized as the Brazilian epicenter for specialty medical training, since it concentrated 66.7% of all vacancies in MR programs and 51.3% (97) in IDRT programs in 2011,[29] mainly in the states of São Paulo and Rio de Janeiro. This region also has the largest population and therefore more demands for specialized healthcare centers and higher numbers of general practitioners and specialists.[2,18] The Northern region, in contrast, exhibits a peculiar epidemiological profile, with high demand for care in tropical infectious diseases, such as malaria, leprosy, typhoid fever, and leishmaniasis, in addition to AIDS, tuberculosis, and viral hepatitis that occur throughout Brazil.[3,16] Infectious diseases are also an important cause of lost years of life in Brazil as a whole, with a greater proportion of infection-related deaths occurring in the North and Northeast.[14]

Two heterogeneous patterns in the distribution of Brazilian IDs can be identified on the presented maps (Fig. 1). When adjusted for the state population (Table 3), the ID distribution was noticeably different among states [Map 1], but also differed within a given state [Map 2]. Dots usually cluster around state capitals and/or in metropolitan areas, even in states where a more homogeneous distribution of ID is noticed (São Paulo, Minas Gerais, Rio de Janeiro and Paraná). This finding suggests that even in states where the estimated ID rates are higher, the availability of IDs in the countryside may not be sufficient.

An important issue to be considered in medical education is whether specialist training centers are able to provide professionals to meet the region's healthcare needs. In this context, we observed that IDs from the Northeastern region

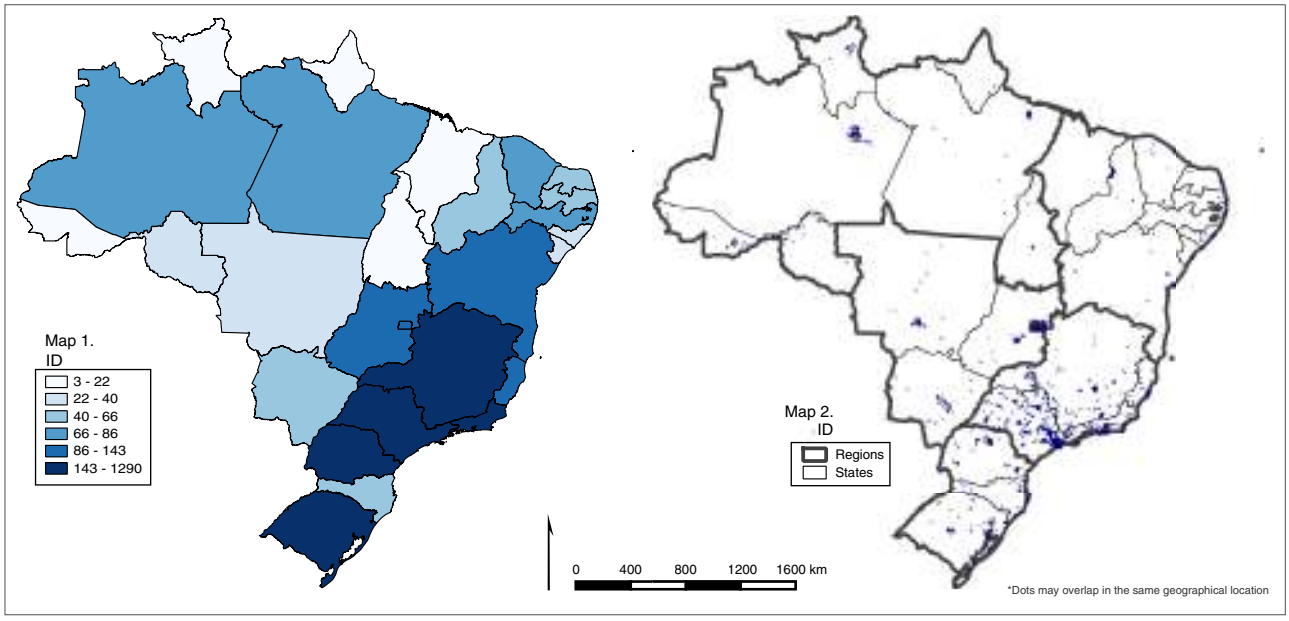

Fig. 1 – (Map 1) Absolute distribution of infectious diseases specialists according to Brazilian states, 2015. (Map 2) Dot density of absolute distribution of infectious diseases specialists by Brazilian municipalities according to Brazilian regions, 2015.

who completed their training locally showed a significant lower time since residency completion (RCt), as compared to those trained in other Brazilian regions. In addition, locally trained specialists are still the minority of IDs (22.3%) in this region. We believe these data can indicate temporal changes in professional allocation. Local institutions are recently training more specialists who get settled in the same region where the IDRT took place. We should consider this as promising, since such specialists are supposed to have experienced clinical challenges during their training that are more likely to be found in the location they have chosen for their professional practice.

Table 5 – Mean time after completion of medical residency training among infectious diseases specialists according to Brazilian regions, 2015.

Region	Residency	ID (*n*)	ID (%)	RCt (mean)	RCt 95% CI	
					Lower	Lower
Northern	δ	30	21.0	8.4	7.1	9.9
	†	113	79.0	11.8	9.6	14.3
	Total	143	100			
Northeastern	δ	78	22.3	8.7	7.9	9.5
	†	272	77.7	13.6	11.8	15.5
	Total	350	100			
Southeastern	δ	1524	97.4	11.8	11.3	12.2
	†	40	2.6	14.8	10.0	17.4
	Total	1564	100			
Southern	δ	83	35.2	8.9	7.5	10.5
	†	153	64.8	11.5	9.7	13.2
	Total	236	100			
Center-western	δ	67	38.7	10.8	10.4	11.2
	†	106	61.3	9.7	7.7	11.6
	Total	173	100			
Total	2466					

δ, physicians living in the same region where specialty training was completed; †, physicians living in a different region from where specialty training was completed; RCt, time since residency completion (years), ID, infectious diseases specialists; OS, other specialist medical doctors; 95% CI, 95% confidence interval; ID, infectious disease specialist.

Our study also found that most Brazilian IDs specialists concluded a medical residency program (81%; 95% CI 79.7–82.3%). The time gap between their graduation and certification as specialists was in average 4.8 years (SD 3.4 years). In fact, 66.1% (95% CI 69.3–73.3) concluded training between 4 and 10 years after graduation. If we take into account that 33.8% of IDs concluded their training in less than 5 years after graduating in Medicine we can have an idea of the number of ID we will have in the next 5 years, in case this rate of formation is maintained.

An interesting finding in our study was the higher proportion of females in infectious diseases practice (57%). This fact could be explained by a higher proportion of young physicians among the IDs, 44.7% of them aged less than 39. In 2013, data analyzed by the Brazilian Medical Demography study[18] noted that infectious diseases was the seventh specialty with more women, following hematology (56.8%), allergy and immunology (60.8%), endocrinology (65%), medical genetics (66.5%), pediatrics (69.6%), and dermatology (72.9%), and the third youngest medical specialist body (mean age 43.3 – SD 10.1), following family and community medicine (41.3 – SD 9.04) and internal medicine (40.6 – SD 9.77). We thus suggest that even though ID are not many in the country, the specialty is more frequently being chosen by recent graduates. In addition, feminization of medicine in Brazil is a consistent trend that has been observed over the past decade and recently emphasized.[18,30] The growth in female participation is evident if we take the number of women trained every year who are entering the job market, based on national data pooled from new CRM records.[31]The increased participation of women in the medical profession is not a recent phenomenon and has not only occurred in Brazil. The proportion of females among physicians from the Organization for Economic Co-operation and Development (OECD) grew between 1990 and 2005 from 28.7% to 38.3% of physicians.[32] In the early 2000s, women were already the majority among American and Canadian medical students,[33,34] and in the 1990s, medical undergraduate courses already had a female majority in several countries, including England,[35] Ireland,[36] and Norway.[37] Further studies are warranted to explain more deeply the factors associated with an increased participation of women in medical practice and, in particular, in infectious diseases care.

The main strength of our study relies on the linkage of strongly robust databases (CFM, CNMR and AMB), containing documented information about specialists in Brazil. Even though information was originally collected for administrative proposes, data analysis enables thoughtful insights. Limitations related to use of secondary data have, nevertheless, to be taken into account. Double registrations, though limited to 5.7% of the sample, were due to the fact that few physicians practiced in more than one state.

In conclusion, we believe our study provides useful information for medical education in Brazil, particularly related to the medical specialty training in infectious diseases provided by academic institutions, and their ultimate impact in specialized healthcare provision. We encourage further studies to consider ID national distribution and its correlation with the burden of infectious diseases that differs among Brazilian regions.

Conflicts of interest

The authors declare no conflicts of interest.

REFERENCES

1. Amato Neto V. Infectologia velha e infectologia nova: concepção extravagante. Rev Soc Bras Med Trop. 2004;37:510–1.
2. Petrak RM, Sexton DJ, Butera ML, et al. The value of infectious disease specialist. Clin Infec Dis. 2003;36:1013–7.
3. Referentiel-metier_infectiologie. Collège des Universitaires de Maladies Infectieuses et Tropicales (CMIT) et Conseil National des Universités (CNU) Sous-section 45/03. Available from http://www.infectiologie.com/site/medias/positions/Referentiel-metier_infectiologie-2011.pdf [accessed 20.06.15].
4. Sampaio SAP. Residência Médica no Hospital das Clínicas: 40 anos de história. São Paulo: FUNDAP; 1984.
5. Foccacia R, Neto VA, Elias PEM. Residência Médica em Doenças Infecciosas e Parasitárias no Hospital das Clínicas da F.M.U.S.P. Rev Hosp Clín Fac Med S Paulo. 1988;43:171–5.
6. Brasil Decreto Presidencial n°. 80.281, de 5 de setembro de 1977. Regulamenta a Residência Médica, cria a Comissão Nacional de residência Médica e dá outras providências. Brasília: Diário Oficial da União; 1977. Available from: http://www.planalto.gov.br/ccivil_03/decreto/1970-1979/D80281.htm [accessed 20.06.15].
7. Brasil Lei n°. 6.932, de 7 de julho de 1981. Dispõe sobre as atividades do médico residente, e dá outras providências. Brasília: Diário Oficial da União; 1981. Available from: http://www.planalto.gov.br/CCIVIL_03/Leis/L6932.htm [accessed 20.06.15].
8. Brasil. Resolução CNRM 01/81. Estabelece especialidades médicas credenciáveis como Programa de Residência Médica e dá providências adicionais. Brasília: Diário Oficial da União; 1981. Available from: http://portal.mec.gov.br/sesu/arquivos/pdf/CNRM0181.pdf [accessed 20.06.15].
9. Brasil. Resolução CNRM 04/83. Dispõe sobre os requisitos mínimos dos programas de Residência Médica das especialidades médicas e dá outras providências. Brasília: Diário Oficial da União; 1981. Available from: http://portal.mec.gov.br/sesu/arquivos/pdf/CNRM0483.pdf [accessed 20.06.15].
10. Brasil Resolução CFM n° 1634/2002. Dispõe sobre convênio de reconhecimento de especialidades médicas firmado entre o Conselho Federal de Medicina CFM, a Associação Médica Brasileira – AMB e a Comissão Nacional de Residência Médica – CNRM. Brasília: Diário Oficial da União; 2002. Available from: http://www.portalmedico.org.br/resolucoes/CFM/2002/1634_2002.htm [accessed 20.06.15].
11. Brasil Resolução CFM N° 2.116/2015. Dispõe sobre a nova redação do Anexo II da Resolução CFM n° 2.068/2013, que celebra o convênio de reconhecimento de especialidades médicas firmado entre o Conselho Federal de Medicina (CFM), a Associação Médica Brasileira (AMB) e a Comissão Nacional de Residência Médica (CNRM). Brasília: Diário Oficial da União; 2015. Available from: http://www.portalmedico.org.br/resolucoes/CFM/2015/2116_2015.pdf [accessed 20.06.15].
12. Sociedade Brasileira de Infectologia. Livro 25 anos SBI.SBI: consolidação da infectologia no Brasil; 2005. Available from: http://itarget.com.br/newclients/sbi/wp-content/uploads/2015/03/livro01.pdf [accessed 20.06.15].
13. Sociedade Brasileira de Infectologia. Concurso para título de especialista em infectologia; 2015. Available from:

http://infecto2015.com.br/Edital_prova_titulo_sbi2015.pdf [accessed 20.06.15].
14. Schramm JMA, Oliveira AF, Leite IC, et al. Transição epidemiológica e o estudo de carga de doença no Brasil. Ciênc Saúde Coletiva. 2004;9:897–908.
15. Luna EJA. A emergência das doenças emergentes e as doenças infecciosas emergentes e reemergentes no Brasil. Rev Bras Epidemiol. 2002;5:229–43.
16. Barreto ML, Teixeira MG, Bastos FI, Ximenes RA, Barata RB, Rodrigues LC. Successes and failures in the control of infectious diseases in Brazil: social and environmental context, policies, interventions, and research needs. Lancet. 2011;377:1877–89.
17. Instituto Brasileiro de Geografia e Estatística. Estimativas populacionais para os municípios brasileiros em 01.07.2013. Available from: ftp://ftp.ibge.gov.br/Estimativas_de_Populacao/Estimativas_2013/estimativa_2013_dou.pdf [accessed 20.02.15].
18. Scheffer M, Biancarelli A, Cassenote A. Demografia Médica no Brasil: cenários e indicadores de distribuição. Conselho Regional de Medicina do Estado de São Paulo e Conselho Federal de Medicina, 117. Available from: http://www.cremesp.org.br/pdfs/DemografiaMedicaBrasil Vol2.pdf [accessed 20.02.15].
19. Efron B, Tibshirani RJ. An introduction to the bootstrap. New York: Chapman & Hall/CRC; 1993.
20. Dolan NC, Martin GJ, Robinson JK, Rademaker AW. Skin cancer control practices among physicians in a university general medicine practice. J Gen Intern Med. 1995;10:515–9.
21. Chin MH, Friedmann PD, Cassel CK, Lang RM. Differences in generalist and specialist physicians' knowledge and use of angiotensin-converting enzyme inhibitors for congestive heart failure. J Gen Intern Med. 1997;12:523–30.
22. Schreiber TL, Elkhatib A, Grines CL, O'Neill WW. Cardiologist versus internist management of patients with unstable angina: treatment patterns and outcomes. J Am Coll Cardiol. 1995;26:577–82.
23. Vickrey BG, Edmonds ZV, Shatin D, et al. General neurologist and subspecialist care for multiple sclerosis: patients' perceptions. Neurology. 1999;53:1190–7.
24. Norquist G, Wells KB, Rogers WH, Davis LM, Kahn K, Brook R. Quality of care for depressed elderly patients hospitalized in the specialty psychiatric units or general medical wards. Arch Gen Psychiatry. 1995;52:695–701.
25. Landon BE, Wilson IB, Cohn SE, et al. Physician specialization and antiretroviral therapy for HIV: adoption and use in a national probability sample of persons infected with HIV. J Gen Intern Med. 2003;18:233–41.
26. Conselho Federal de Medicina. Estatística. CFM; 2015. Available from: http://portal.cfm.org.br/index.php?option=com_estatistica [accessed 20.02.15].
27. Read RC, Cornaglia G, Kahlmeter G, et al. Professional challenges and opportunities in clinical microbiology and infectious diseases in Europe. Lancet Infect Dis. 2011;1:408–15.
28. Scheffer MC, Escuder MM, Grangeiro A, Castilho EA. Formação e experiência profissional dos médicos prescritores de antirretrovirais no Estado de São Paulo. Rev Assoc Med Bras. 2010;56:691–6.
29. Chaves HL, Borges LB, Guimarães DC, Cavalcanti LPG. Vagas para residência médica no Brasil: Onde estão e o que é avaliado. Rev Bras Educ Med. 2013;37:557–65.
30. Scheffer M, Biancarelli A, Cassenote AJF. Demografia médica no Brasil. Dados gerais e descrições de desigualdades. Relatório de pesquisa. São Paulo, SP: Conselho Federal de Medicina e Conselho Regional de Medicina do Estado de São Paulo; 2011. Available from: http://www.cremesp.org.br/pdfs/demografia_2_dezembro.pdf [accessed 20.06.15].
31. Scheffer MC, Cassenote AJF. A feminização da medicina no Brasil. Rev Bioét. 2013;21:268–77.
32. Organisation for Economic Co-Operation and Development. OECD health data 2009: comparing health statistics across OECD countries. OECD; 2009. Available from: http://www.oecd.org/document/57/0,3746,en_21571361_44315115_43220022_1_1_1_1,00.html [accessed 22.04.15].
33. Jonasson O. Leaders in American surgery: where are the women? Surgery. 2002;131:672–5.
34. Beagan BL. Neutralizing differences: producing neutral doctors for (almost) neutral patients. Soc Sci Med. 2000;51:1253–65.
35. McManus IC, Sproston KA. Women in hospital medicine in the United Kingdom: glass ceiling, preference, prejudice or cohort effect. J Epidemiol Community Health. 2000;54:10–6.
36. McDonough CM, Horgan A, Codd MB, Casey PR. Gender differences in the results of the final medical examination at University College Dublin. Med Educ. 2000;34:30–4.
37. Kvaerner KJ, Aasland OG, Botten GS. Female medical leadership: cross sectional study. BMJ. 1999;318:91–4.